PB-216 237

EVALUATION OF EXTERNAL SEALING METHOD TO REDUCE STORM FLOW EFFECTS IN SEWERAGE SYSTEMS. APPENDIX

Donald B. Head

Sonoma County Sanitation Department
Sonoma, California

1966

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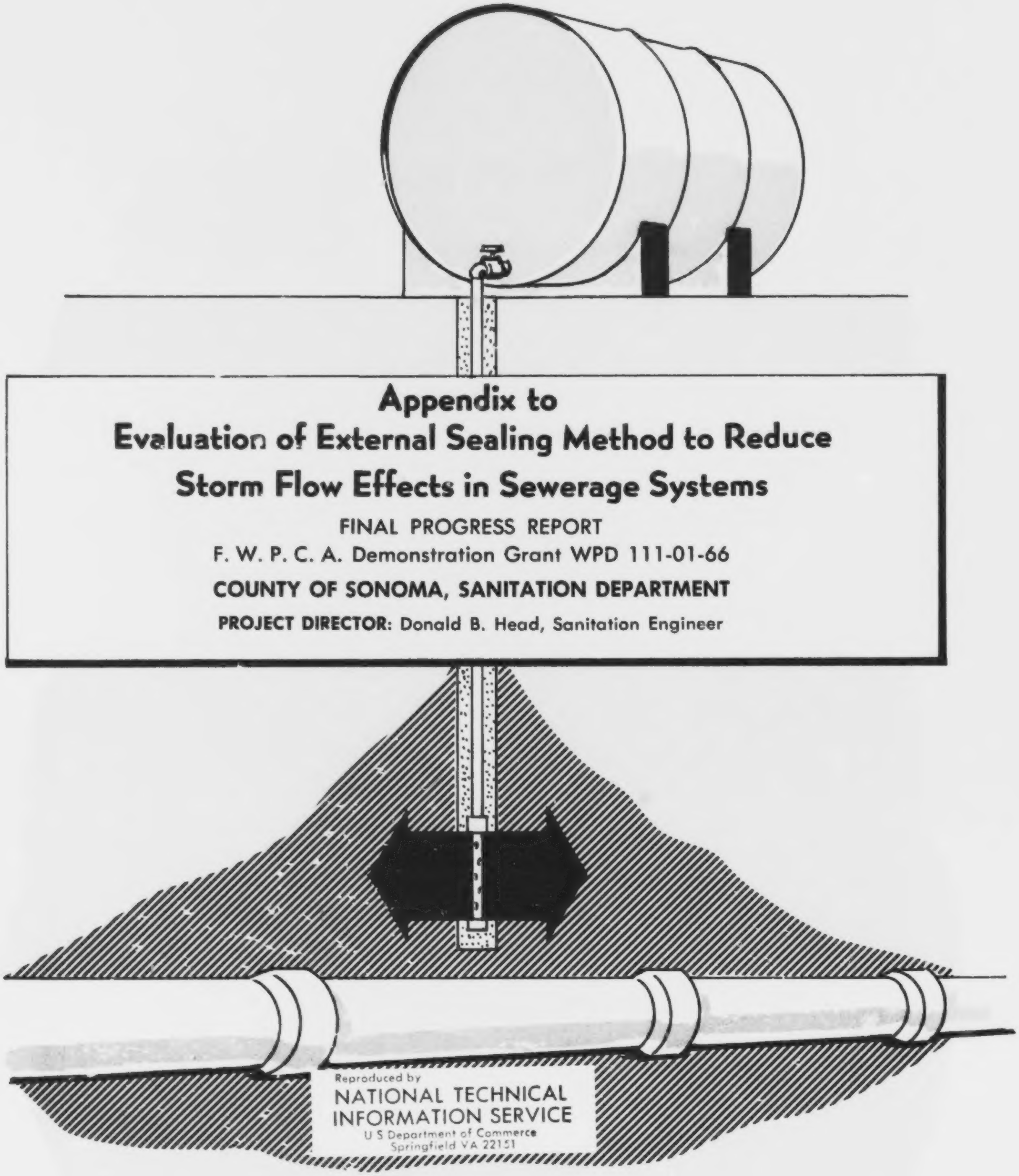

Appendix to
Evaluation of External Sealing Method to Reduce Storm Flow Effects in Sewerage Systems

FINAL PROGRESS REPORT

F. W. P. C. A. Demonstration Grant WPD 111-01-66

COUNTY OF SONOMA, SANITATION DEPARTMENT

PROJECT DIRECTOR: Donald B. Head, Sanitation Engineer

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APPENDIX TO

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F.W.P.C.A DEMONSTRATION GRANT WPD 111-01-66

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PROJECT DIRECTOR: DONALD B. HEAD, SANITATION ENGINEER

This project was supported in part by Federal Water Pollution Control Administration Grant WPD 111-01-66 from the United States Department of the Interior.

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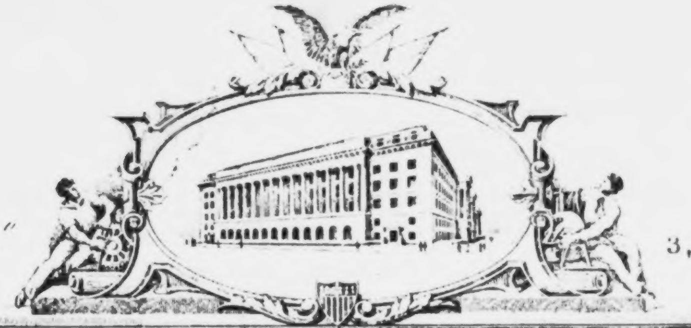

3,084,719

THE UNITED STATES OF AMERICA

TO ALL TO WHOM THESE PRESENTS SHALL COME:

Whereas Marshall M. Wallace and Eugene B. Dykes, of Santa Rosa, California, assignors to the County of Sonoma of the State of California, of Santa Rosa, California,

PRESENTED TO THE **Commissioner of Patents** A PETITION PRAYING FOR THE GRANT OF LETTERS PATENT FOR AN ALLEGED NEW AND USEFUL INVENTION THE TITLE AND A DESCRIPTION OF WHICH ARE CONTAINED IN THE SPECIFICATION OF WHICH A COPY IS HEREUNTO ANNEXED AND MADE A PART HEREOF, AND COMPLIED WITH THE VARIOUS REQUIREMENTS OF LAW IN SUCH CASES MADE AND PROVIDED, AND

Whereas UPON DUE EXAMINATION MADE THE SAID CLAIMANT s are ADJUDGED TO BE JUSTLY ENTITLED TO A PATENT UNDER THE LAW.

NOW THEREFORE THESE **Letters Patent** ARE TO GRANT UNTO THE SAID County of Sonoma of the State of California, its successors OR ASSIGNS FOR THE TERM OF SEVENTEEN YEARS FROM THE DATE OF THIS GRANT

RIGHT TO EXCLUDE OTHERS FROM MAKING, USING OR SELLING THE SAID INVEN- THROUGHOUT THE UNITED STATES.

In testimony whereof *I have hereunto set my hand and caused the seal of the* **Patent Office** *to be affixed at the City of Washington this* ninth *day of* April, *in the year of our Lord one thousand nine hundred and* sixty-three, *and of the Independence of the United States of America the one hundred and* eighty-seventh.

Attest:

Ernest W. Swider
Attesting Officer.

David L. Ladd
Commissioner of Patents.

FORM PO-377A

P-1

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April 9, 1963 **M. M. WALLACE ETAL** 3,084,719

METHOD OF SEALING SEWER LINES AGAINST LEAKAGE

Filed March 15, 1960

FIG _ 1

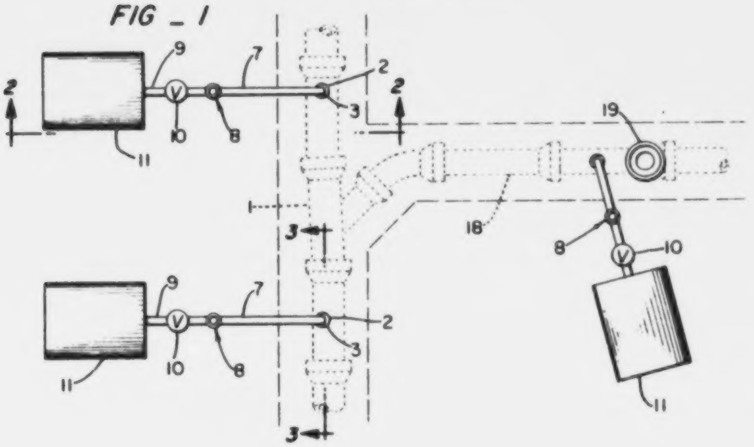

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FIG _ 2

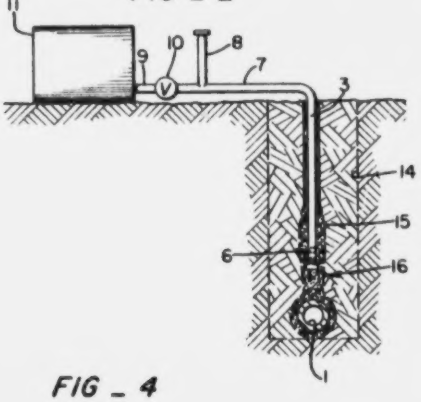

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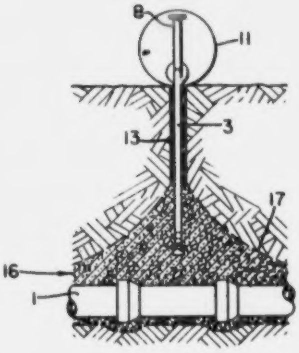
FIG _ 3



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17
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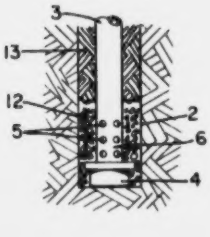
FIG _ 4



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United States Patent Office

3,084,719
Patented Apr. 9, 1963

3,084,719
METHOD OF SEALING SEWER LINES AGAINST LEAKAGE

Marshall M. Wallace and Eugene B. Dykes, Santa Rosa, Calif., assignors to the County of Sonoma of the State of California, Santa Rosa, Calif.

Filed Mar. 15, 1960, Ser. No. 15,179
2 Claims. (Cl. 138—97)

This invention relates to a method of sealing sewer lines against leakage and has for one of its objects the provision of a method for effectively and economically stopping the leakage of ground water into sewer lines and for effectively stopping the leakage of sewage out of such lines, with such sealing to be done from outside the sewer lines and appurtenances.

The problem of sealing sewer lines against leakage exists in all municipalities, since the spigot-bell joints in the pipes are particularly susceptible to leakage. Also the pipes are susceptible to cracking under strains that may be imposed thereon from different sources.

One of the methods heretofore adopted for sealing sewer lines against leakage has been that of applying various sealants to the inside of the sewer pipe.

At best this method is costly at locations where it can be used. All excess sewage flowing into the section of the line being treated with the sealant must be pumped past the section to the next downstream manhole, which poses a real problem where manhole spacing is excessive and where sewage flows are high.

In hilly terrain or where distances between manholes are large, the internal sealing method is prohibitive in cost since it would require exposing the pipe at close intervals and plugging it at such intervals during the sealing operation to prevent the building adjacent to the lines being treated from being flooded.

The above are only a few of the objections to the method of sealing sewer lines internally.

Any method of externally sealing the sewer lines that would require exposing the pipe, or excavating the earth where the pipe is at a known depth, is prohibitive in instances where the leakage is such as can be substantially stopped without replacement of the pipe itself. In most instances, such replacement is not essential, inasmuch as such leakage usually occurs at the joints where the pipe itself is good. Furthermore where the sewer lines are below streets, and in which instances the pipes are at a known depth, the exposing of the pipe would require making excavations that would be obstacles to the rapid flow of traffic, as well as creating dangerous hazards for motorists and pedestrians, to say nothing of the road damage and expense of re-paving portions thereof.

Attempts to externally seal sewer pipes against leakage by driving pipes into the ground and attempting to drive cement through such pipes to jacket the joint or opening have not been generally adopted due to the virtual impossibility in some instances of forcing the cement into the hard packed soil and also due to lack of any control over where the discharge material will flow.

It is pertinent to note that while the depth of the pipe below the surface of the ground is known where the sewer lines are under the street, and while the course of the lines is readily determined, the exact location of the joints or points of leakage is not determinable. The sewage usually tends to flow along and below the pipe, creating channels, and in many instances substantial voids or pools may be formed that may be around or adjoining the pipe at the point of leakage or at points a substantial distance therefrom. While evidence of leakage is not usually evident at the surface of the ground, such evidence, if it existed, would not necessarily be determinative of the location of the point of leakage.

In view of the above, it is manifest that a method of applying the sealant externally must be economical since most of the lines shoulde be treated at sufficiently close intervals along the lines to insure sealing the joints.

By the present method, the soil around the line is loosened and processed to facilitate the flow of the sealant around and along the pipe including the joints and any openings in the pipe so that the flow of the sealant will be controlled to the end that it will pass to the area where it will effectively seal the sewer line against leakage. This is accomplished by the present method substantially without road damage through excavating to expose the sewer pipe, and without interfering with traffic for more than substantially the time to drill the desired number of small diameter holes to points spaced above the pipe and to insert sealant feed pipes into the holes so drilled. There is no plugging of the sewer line being treated nor possibility of house flooding, nor by-passing of sewage during the sealing operation.

Furthermore, by the present method, observation of the effectiveness of the sealing operation is made possible so the operator can quickly determine if the sealant is reaching the points where leakage is occurring.

Other objects and advantages will be obvious from the description and drawings.

In the drawings,

FIG. 1 is a semischematic plan view illustrating a typical application of one of the steps of the method of sealing sewer lines, such as a main sewer line and a house service line.

FIG. 2 is a sectional view along line **2—2** of FIG. 1.

FIG. 3 is a sectional view along line **3—3** of FIG. 1, with the sewer pipe in elevation.

FIG. 4 is an enlarged fragmentary sectional view at the discharge end of the sealant delivery pipe showing the end of the pipe in elevation.

In detail, one of the first steps to be taken is to locate the sewer line to be treated, which is accomplished in the usual manner by inserting a steel sewer cleaning rod into the line. An electronic metal detector above the surface of the ground will indicate the path of the cleaning rod, which, of course, is the path of the sewer line.

After the main sewer line **1** and its course are determined, substantially equally spaced vertical holes **2** (FIGS. 1, 4) are drilled over said line from the surface of the ground or pavement, to a predetermined spaced safe distance above the sewer pipe. The space between the sewer pipe and the bottom of the hole that is drilled should be such that there is no likelihood of the pipe being damaged by the drill.

It has been found that approximately 0.8 of a foot is a safe distance, although this method is not necessarily restricted to this distance.

Insofar as the spacing between holes is concerned, this is largely determined by the type of soil encountered, since the spacing between holes may be greater in sandy or loose soil than where it is clay or hard packed.

After each hole **2** is drilled, an applicator pipe **3** is lowered into the hole, which pipe may be a plain steel pipe having a closure cap **4** thereon closing the lower end (FIG. 4) and formed with a plurality of spaced openings **5** in its sides adjacent to the cap. The hole **2** is slightly larger in diameter than the outside diameter of the pipe **3** therefore the pipe may be readily lowered into the hole **2** until the cap **4** rests on the bottom of the latter. The openings are preferably restricted to the last four or five inches of the pipe along its length adjoining the cap, but this exact distance is not to be considered restrictive, since it may vary. This lower portion of pipe **2** may be generally designated **6** and will be called the "applicator."

The upper end of the applicator pipe **3** will normally extend slightly above the surface of the ground, or pavement, and is connected by an elbow with a horizontally extending length of pipe **7** of sufficient length to extend to one side of the street or highway where the leg of a T fitting connects with a riser pipe **8** that, in turn, is fitted at its upper end with a suitable pressure fitting for connection with any suitable means for applying pressure to oil to be introduced into the pipes **3**, **7**.

A horizontal pipe **9** having a manually actuable valve **10** thereon connects the T fitting on pipe **7** with the lower end of a supply tank **11**.

Pipe **7**, being on the pavement or ground, may be held down by suitable staples to enable vehicles to pass thereover without dislodging it, or it may be bridged if desired. In any event, the presence of the pipe **7** does not obstruct the normal flow of traffic when it is on the street.

The lower end of hole **2**, from the bottom thereof to at least the upper level of the applicator **6**, may be filled with material **12** such as pea gravel or any material suitable for preventing closure of the openings **5** against flow of oil or liquid therethrough. Usually a handful or two of this material is adequate.

Earth or other materials of small increments **13** (FIG. 4) may then be tamped into the hole around the pipe **3** to close off the latter above the level of the applicator.

The container **11** and pipes **9**, **7**, **3** are then filled with a primary sealant such as a low viscosity road oil. A cutback oil commonly known as SC–1 is suitable, and this oil will extend up into the riser pipe **8** to the same level as the oil level in tank **11**. The oil well known in the industry as SC–1 is a liquid petroleum product, produced by fluxing an asphaltic lease with suitable distillates. A condensed specification of this product is as follows:

Characteristic	A.S.T.M. Test Method	Requirement
Flash Point, ° F.	D92	150+
Furol Viscosity @ 122° F. Sec.	D88	75-150
Water, percent	D95	0.5−
Distillation		
Total Distillate to 680° F.	D402	10-30
Float Test on Residue @ 122° F. sec.	D139	20-100
Asphalt Residue of 100 Penetration, percent.	D243	50+
Ductility Asphalt Residue @ 77° F.	D113	100+
Solubility in CCl_4, percent	D4[1]	99.5+

[1] Except that CCl_4 is used instead of carbon disulphide as solvent, Method No. 1. If the material fails to meet the requirement for solubility it will be acceptable if its solubility in carbon disulfide is 99%+ and proportion of bitumen soluble in CCl_4 is 99.65%+.

A fluid pressure line (not shown) is then connected with the upper end of the riser pipe. The valve **10** is closed and fluid pressure is applied to the oil in applicator pipe **3** from any suitable source, such as a pump, to a degree sufficient to "crack" the soil above the pipe line to enable the sealant to penetrate the soil from the applicator **6** to the sewer pipe **1**. A pressure of from approximately 40 to 80 lbs. per square inch is usually adequate to accomplish this "cracking" or breaking of the soil, sufficient to enable penetration and distribution of the oil to the sewer pipe, and as soon as this happens, the occurrence is apparent from a sharp drop in the applicator pressure. As soon as this pressure drop occurs, indicating that the soil to the sewer pipe has been broken, the pressure applied to the sealant is removed and valve **10** is opened, permitting the sealant in tank **11** to flow by gravity from said tank through the applicator **6** and into the soil.

No exact amount of pressure for accomplishing the desired "cracking" step can be established, nor can the exact amount of sealant to be used be determined in advance.

The type of soil encountered largely determines the pressure required for the cracking step. The amount of sealant required per foot of line sealed will be determined by the soil type; condition of sewer lines and appurtenances being treated, etc. In some cases where the soil is largely impervious to water and the original trench excavation was held to a minimum and line leakage is not excessive, the quantity of primary sealant required may be approximately one gallon per foot of sewer line. In other instances where the soil conditions made abnormally large trench excavations necessary, the quantity of primary sealant may be several times one gallon per foot.

As seen in FIG. 2 the walls **14** may indicate the walls of the original trench in which the sewer pipe was laid. The line **15** around the applicator pipe and sewer pipe indicates, generally, the outline of an area **16** that is penetrated by the sealant, and this area is within the "fill" that is within the original trench. This fill being originally loose material, is the material that is "cracked." FIG. 3 indicates the same area **16** extending longitudinally of the pipe **1**, the upper line **17** of which indicates the hydraulic gradient of the sealant during application.

The soil around the pipe itself, including the underside, is, of course, directly in contact with the leaking sewage, hence is loosened, and normally channels will form in the soil along the pipe, from the points of leakage into which the sealant will readily flow. Also the soil type is normally logged, which is to some extent determinative of the degree of penetration that will be accomplished by the oil.

This primary sealant itself does not seal the pipe line, but it prepares a pathway for a rapid set emulsified asphalt that will follow, and which is generally known under the designation of RS–1, which is an asphalt emulsion with water. This pathway prepared by the primary sealant is essential to prevent spontaneous breaking of the emulsified asphalt upon contact thereof with dust or dirt particles, rock, surface of sewer pipe, etc., which would prevent the necessary penetration and distribution thereof before effective penetration and distribution has been effected.

RS–1 emulsified asphalt used in the present method, conforms to American Society of Testing Materials (A.S.T.M.) designation D977–57 and has a Saybolt Furol viscosity, 60 ml. at 77° F. (25° C.) of 20–100 sec.

After the desired amount of the primary sealant has penetrated the soil around the sewer pipe for the desired distance along the latter, a secondary sealant comprising said RS–1, or emulsified asphalt, is placed in tank **11**, which secondary sealant may have approximately a low viscosity similar to water, or to the primary sealant.

The valve **10** is then opened and the secondary sealant is permitted to flow by gravity through the applicator and into the previously treated soil. Proper sealant distribution cannot be obtained through auxiliary pressure applicator to the sealant, such as has been attempted with cementitious material alone.

It is obvious that the success of the applicator of the secondary sealant is dependent in the coverage obtained by the primary sealant, and which coverage has been mentioned hereinbefore. Usually the quantity of the secondary sealant used is approximately the same as the quantity of the primary sealant that was used.

During the application of the secondary sealant, the sewer line is preferably flushed to the extent required to remove the sealant from the lines, which may be accomplished by use of a conventional sand trap at the downstream side. Normally observation of the flushing water at the downstream side will also indicate by discoloration thereof, and the presence of the primary sealant, and later the secondary sealant, that the sealants have reached the leak or leaks.

Various techniques may be used to stop large breaks or openings in the sewer pipe, such as the application of salt or other de-emulsifiers to the emulsified asphalt at the opening or break in the pipe, which application may be made interiorly of the pipe by salt water, or whatever de-emulsifier is used. This effects a very rapid hardening of the asphalt emulsion upon its contact with the salt water.

The same method may be practiced for sealing a house service sewer pipe **18** (FIG. 1). Usually in this instance the hole for the applicator is formed next to the property line clean out **19** of the house service sewer. In the event the depth of the pipe below the surface of the ground is not known, the hole for the applicator may be hand dug instead of being drilled, so as to eliminate the likelihood of accidental damage to the pipe. In such house service lines the pipe will be of substantially less depth than the main sewer line with which they connect, and also there is normally no pavement to dig up or to disturb.

The area **16** (FIGS. 2, 3) indicates the solidified sealant, which encloses the joint and pipe **1** a substantial distance along the sewer line. The spacing between holes **2** will determine whether the areas **16** from adjacent holes will join to form a complete covering for the sewer line of any desired length, according to the spacing of the applicator.

While the primary sealant, which is a liquid that is miscible with the asphalt emulsions, has been described as penetrating the soil, and as forming passageways to and around the pipe, it could be said to coat the pipe, rock and soil particles so that the asphalt emulsion will not contact any dust, or uncoated rock or sewer surfaces that would cause breaking of the asphalt emulsion. The loosening of the soil by the application of pressure to the primary sealant merely enables the primary sealant to pass through the soil to form sealant lined passageways for the secondary sealant.

After the desired amount of asphalt emulsion has been applied through the applicator, the latter may be quickly removed by blowing the material **13** out of each hole **2** by air ejected into the hole through a small pipe. In this connection it should be noted that the pipe **3**, after being positioned in the hole **2** and after material **13** is tamped around it, cannot be removed until said material **13** is removed. Any attempt to pull it out of the ground by sheer force will, until the tamped material is removed, break the pipe, but the use of compressed air directed against the material **13** quickly removes it so the pipe may be quickly removed.

We claim:

1. The method of sealing leaks in underground sewer pipe along which leakage therefrom has formed channels and loosened soil, that comprises the steps of:

(*a*) discharging a road oil having approximately the viscosity of water into the body of soil at a point adjacent to but spaced above a portion of said pipe along which said channels and loosened soil are located at a pressure sufficient to crack the soil between said channels and loosened soil, and said point to provide a passageway for said oil from said point to said portion of said pipe and to said channels and said loosened soil; then

(*b*) discontinuing said pressure on said oil; then

(*c*) supplying a sufficient amount of oil to said passageway for flowing therethrough and through said channels and said loosened soil to coat the walls of said channel and the particles of said loosened soil with said oil, and then,

(*d*) discontinuing the supply of said oil to said passageway, and

(*e*) discharging a sufficient quantity of asphalt emulsion of approximately the viscosity of said oil through said passageway and into said channels and loosened soil to fill the interstices between the discrete particles of said soil and to flow through and fill said channels and to surround said portion of said pipe whereby said asphalt emulsion will seal said portion of said pipe against leakage, and then

(*f*) ceasing the discharge of said asphalt emulsion into said passageway and permitting said asphalt emulsion around and against said pipe to solidify.

2. The method of sealing leaks in underground sewer pipe along which the leakage therefrom has formed channels and loosened soil, that comprises the steps of:

(*a*) forming a hole in the ground from the surface thereof to a point spaced from a portion of said pipe along which said channels and loosened soil are located leaving soil between said portion and said hole;

(*b*) discharging an oil having substantially the characteristics of "SC-1" into said hole under pressure sufficient to crack the soil between said hole and said portion to provide a passageway for oil from said hole to said channels and loosened soil; then substantially immediately thereafter

(*c*) discontinuing the pressure on said oil and coating the walls of the interstices between particles of said soil and the walls of said channel with said oil by supplying oil to said hole and permitting the oil so supplied to flow by gravity from said hole through said channels and said loosened soil; then

(*d*) discontinuing the supply of oil for flowing by gravity through said channels and said loosened soil; and thereafter

(*e*) discharging a quick set water asphalt emulsion having substantially the characteristics of "RS-1" through said passageway from said hole and into said loosened soil and channels to fill them and to surround said pipe in engagement with the latter.

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June 7, 1957

REPORT ON THE SONOMA VALLEY COUNTY SANITATION DISTRICT SEWERAGE SYSTEM

Preface

The main portion of the Sonoma Valley County Sanitation District is located in the general area lying to the north and west of the City of Sonoma and encompasses some 2950 acres. A recent annexation to the District is located to the west and south of the said City of Sonoma.

The District sewage treatment plant is situated a short distance north of Schellville Station and from the sewage treatment plant an outfall line carries the treated sewage to Schell Slough. A trunk line, which carries the raw sewage from the District to the treatment plant, extends in a northerly direction from said treatment plant to its present point of termination, at the Sonoma State Hospital.

Figure I, accompanying this report, (Figure I omitted from collation because of space limitations) shows the District boundary outlined in red. The solid black line indicates the present trunk line. It should be noted that the trunk line branches at the junction of State Highway 12 and Riverside Drive, one branch continuing, as heretofore described, to the Sonoma State Hospital while the other branch extends to the west of Sonoma Creek.

The large proportion of the sewage entering the trunk lines eminates from three Local Improvement Districts within the Sanitation District, the City of Sonoma and the Sonoma State Hospital.

Figure I shows the area within the boundaries of the various local improvement districts as well as the locations of the City of Sonoma and the Sonoma State Hospital, all in relation to the District trunk lines.

The treatment plant, placed in operation on November 1, 1954, was designed to treat 2.0 M.G.D. (Average daily flow) of sewage. The pumping capacity of the plant is slightly under 6.0 M.G.D., this figure being just under the unsurcharged trunk line capacity of the line leading to the plant.

The original costs of the various components of the District sewerage system are as follows:

Treatment Plant	$ 428,267.37
Trunk Line (Section 1, 2 & 3)	639,966.40
L.I.D. #1	447,775.50
L.I.D. #2	354,681.10
L.I.D. #3	24,710.80
Miscellaneous	42,322.80
Total Cost	$1,937,723.97

The present assessed valuation of the District as represented by the secured tax roll is $5,394,120.00 and the present tax rate is $2.04/$100.00 assessed valuation. This $2.04 rate is composed of $1.53 for the general fund and $0.51 for interest and debt reduction.

REPORT ON THE SONOMA VALLEY COUNTY SANITATION DISTRICT SEWERAGE SYSTEM.

Currently pending action on various projects with the Sonoma Valley County Sanitation District, hereinafter called the District, by the District Board of Directors, makes it advisable to bring together as many of the factors as possible effecting the operation of this sewerage system. This report is an endeavor to show the present effects on the sewerage system of these various factors, the future effects on the system which can be expected and the possible courses of action which can be taken by the District and the probable results effected by such courses of action.

The order in which the various elements covered by this report are considered is as follows:

I. PRESENT SEWAGE FLOWS.

This category contains the data pertinent to the present actual sewage flows and the present possible sewage flows in the various sections of the District sewerage system.

The term "sewage flow", as used herein, means the actual contents of the sewer line, regardless of the relative concentration of sewage to infiltrated surface or ground waters.

By "present actual sewage flows" is meant the actual measured or estimated quantity of sewage presently found within the District sewerage system at any stated location in the system and at any stated time.

The term "present possible sewage flow" is meant to convey the meaning of that quantity of sewage that would presently be possible to remove from a given area if the present sewerage system were capable of removing said sewage. An example of the use of this term would be that of an area contributing 1.0 c.f.s. (cubic feet/sec.) of sewage to a line having a capacity of 0.5 c.f.s. Obviously, the present actual sewage flow in the system would be 0.5 c.f.s., the other 0.5 c.f.s. either overflowing the system or, as in the case of ground water in relation to a line surcharged to the point of overflowing on the surface of the ground, it would mean that 0.5 c.f.s. of said ground water could not enter the system. However, if the collection system were enlarged to give unsurcharged flow in all such District lines in the area the "present possible sewage flow" from the area of the example would be 1.0 c.f.s.

An illustration of the difference between the terms "present actual sewage flows" and "present possible sewage flows" can be seen by comparing Figures IB and IIB of SKETCH I, herein. Figure IB shows the condition where a sewer pipe running completely full is surrounded by water. Under such a condition sewer pipe is carrying the maximum amount of sewage possible and flow from such a sewer line could be considered the maximum "present actual sewage flows".

Again referring to SKETCH I, Figure IIB shows the case where, even though the elevation of the surrounding water is at the same height in relation to the sewer pipe as that shown in Figure IB, the pipe is carrying something less than its full capacity. Thus the sewer pipe is able to carry off a greater amount of infiltrating water than that described in the former case and this reasoning is the basis of the terms "present possible flow". This latter term indicates the possible amount of sewage which could be contributed by an area if conditions were such that the collection system was capable of removing both the sewage and infiltrating water and still not become surcharged.

Again referring to SKETCH I, Figures IA, IIA and IIIA illustrate the type of action encountered during the exfiltration tests which were run in the several L.I.D.'s. The first of a series of tests run in a given section of line gave very high exfiltration rates while the following tests showed a lesser degree of water leakage, indicating, as shown in the hereinbefore mentioned Figures IA, IIA and IIIA, that as the testing water leaked out of the joints it was retained within the more or less impervious walls of the original trench. As the water level rose on the outside of the pipe into the surrounding backfill material the effective testing head within the pipe was reduced with a consequent reduction in the pipe exfiltration rate. Obviously, as the water level in the trench rises following sustained rainfalls the reverse procedure occurs and the so called process of infiltration of ground water into the sewer pipes takes place.

II. ULTIMATE SEWAGE FLOWS

This category of the report contains the data pertinent to the ultimate sewage flows which can be expected in the various sections of the sewerage system.

Any design of a collection system providing for the ultimate development of the District must of necessity take into consideration the ultimate peak flows which the system must handle. The ultimate peak flow in this case being the ultimate average sewage flow increased by some predetermined factor to provide for the inevitable flows of substantially greater than average rate of flow.

III. REQUIRED IMPROVEMENTS TO SEWERAGE SYSTEM

Under this category are listed such items as the trunk line extensions necessary to furnish the means of transmitting sewage from presently unsewered areas; supplementary trunk lines to relieve existent lines of excessive sewage loading; and outfall lines for transmitting sewage from the treatment plant to the point of outfall.

Under this heading are also briefly discussed some presently required treatment plant improvements. However, as discussed later in this report, no attempt is presently made to determine the ultimate treatment plant requirements.

I

PRESENT SEWAGE FLOWS

The sewage flow to the sewage treatment plant is made up of flows from three separate and distinct sources. These sources are (1) the City of Sonoma, (2) the

Sonoma State Hospital and (3) the District flow which is predominantly from L.I.D.'s 1, 2 and 3.

The City of Sonoma began metering the City flow on August 11, 1955, and the Sonoma State Hospital began metering the State Hospital flow on November 17, 1955. The District treatment plant officially commenced operation on November 1, 1954. Between November 1, 1954, when the treatment plant started operations, and the time when the City of Sonoma and the Sonoma State Hospital began metering their sewage, the individual flows from these latter two sources were estimated for purposes of calculating sewage treatment charges. On that basis the District flow was strictly a matter of conjecture, being considered the total plant flow less the sum of the estimated City of Sonoma and Sonoma State Hospital flows.

Subsequent to November 17, 1955, the District flows, with the exception of periods when said flows exceed the capacity of the various meters, have been accurately determined by deducting the sum of the aforesaid City of Sonoma and Sonoma State Hospital flows from the total plant flow as recorded at the treatment plant.

Plates I & II, as included herein, show the flows from the various sources during the period subsequent to the placing in operation of the Sonoma State Hospital flow meter to March 31, 1957.

Plate III shows the District flows subsequent to November 17, 1955.
(Plates I - III incl., omitted from collation because of space limitations)

The treatment plant was put into operation on November 1, 1954 and on December 6, 1954 the Chief Operator's log notes the fact that certain trunk line manholes above the plant were overflowing. The plant meter readings for this period of time (approximately 6 days in duration) show flows of less than 2.5 M.G.D. this being due to the fact that only this amount was pumped through the plant, the rest of the flow being by-passed around the plant or overflowing into the creek from the bypass manhole.

In the press of other duties, such as are required to put a new treatment plant into operation, no unusual significance was attached to this six-day period of overflowing lines. As the 1954-55 winter had but fairly light, sporadic rainfall (The total for the period being some 21.46 inches as compared to a normal rainfall of approximately 30"), there were no more overflows recorded during the first winter's operation, although the daily average flows during this winter's operation were several times greater than the initial dry weather flows.

During the winter of 1955-56 the picture changed rapidly. The frequent moderate to heavy storms of that period caused long periods of by-pass operation of the treatment plant and overflows were common in various places in the District system.

As the seriousness of the problem became apparent several steps were taken by the District to both relieve the areas effected by said overflows of the resulting nuisance, and to set up a plan of study to ascertain the extent and type of leakage into the system.

The former step was accomplished by constructing a hydraulic control structure in conjunction with pressurizing eight manholes, all in the trunk line between the treatment plant and the vicinity of Splude Road. The immediate purpose of the hydraulic control structure was to provide a means of pressurizing the trunk line leading to the plant in order that the resulting hydraulic gradient would be such that any flows in excess of the present pumping capacity of the plant (slightly less than 6.0 M.G.D.) would be by-passed directly into Schell Creek. Thus the sewage solids would be placed in the creek where the high flows would prevent the settling of the solids on the flood plain surrounding the overflowing manholes, as was the case prior to the construction of this structure. This structure also prevented flood waters of

Schell Creek from draining to the plant subsequent to rainy periods. The hydraulic control structure was further designed so that, in the event the pumping capacity of the plant is increased to handle the ultimate flows which could be transmitted by this particular trunk line, the total flow could be transmitted to said plant with no overflows.

It might be added that this hydraulic control structure was not built until a permissive resolution authorizing such an overflow was passed by the State Water Pollution Control Board No. 2.

The requirements for the waste discharge by this structure stipulate that:

1. ---"None of the following conditions shall occur at any point in the waters of or along the banks of Schell Creek as a result of the proposed waste discharge:

   Grease, scum or other material of sewage origin;

   Odors of sewage origin;

2. ---None of the following conditions shall occur, as a result of this discharge, at any point in the waters of the tidal reach of Schell Creek;

   Depletion of dissolved oxygen below a minimum of 4.0 p.p.m.;

2. ---No sample of the proposed waste discharge collected and analyzed ----shall have a settleable solids concentration of more than 2.0 ml/liter/hr.; . . . . . . ".

It should be noted that the above requirements for the waste discharge of the said overflow structure are essentially the same as those required by the Water Pollution Board for the treatment plant, the only additional requirement for the treatment plant being "adequate disinfection". These plant effluent requirements were prescribed by the aforesaid Water Pollution Control Board by letter to the Board of Directors of the Sonoma County Sanitation District, dated August 17, 1950.

A further requirement for the hydraulic control structure is, of course, that this overflow structure be a temporary expedient and the Water Pollution Control Board insists upon the District filing a progress report with the Board at six-month intervals until the overflow discharge is eliminated.

The latter step which the District took, namely that of initiating a study of the system to ascertain the reason for the high winter flows, was started in the fall of 1956.

It was apparent that some system of measurement had to be set up to measure the peak flows through the trunk lines in order to gain some idea as to the quantity of sewage being carried through the lines at such times that overflows within the system were taking place.

Measurements of this type have been made in similar circumstances by other districts making such surveys, but several factors influenced the type of metering devices which were ultimately constructed by the Sonoma Valley County Sanitation District. These controlling factors were; limited time, limited finances and limited manpower.

The metering system finally installed was similar to the now familiar air control devices commonly used to control the pumping sequence of pumping equipment. This consisted of the installation of air tubes extending from the tops of the various manholes to points of known elevation slightly above the crowns of the pipe within the manholes. Openings to provide access to the air tubes without the necessity of removing the manhole covers were made in the manhole covers and the air tubes were provided with readily removable plugs to preclude the entrance of dirt and rock therein.

A portable metering device, operating from a tank of compressed oxygen, was built to be used in conjunction with the aforesaid air tubes.

These devices were installed in various manholes located along stretches of sewer line where said sections of sewer lines were of uniform size. From the readings determined by the use of these measuring devices the hydraulic gradient can be determined for the particular stretch of line under scrutiny. From this hydraulic gradient and the known size and type of pipe the flows occurring during such times as the readings were made can be calculated.

This method of flow measurement was supplemented by the use of three dimensional colored photography. This photographic method permits the compilation of permanent records of sewage flows in various parts of the District at any predetermined time, the three dimensional feature permitting a quantitative comparison of flows which can not be obtained by conventional photography.

Photographs of a large majority of District manholes were taken at different times of the day and night during periods of dry weather flow. These photographs, in slide form, offer a basis of comparison for later wet weather studies, the wet weather photographs being taken at various times during periods of rainy weather.

As the past winter wore on it became evident that the unseasonal dryness would limit the number of measurements obtainable from surcharged lines. Therefore, a program was initiated to directly water test certain lines in various sections of the District.

This water testing program was carried out in Local Improvement Districts 1 and 2, and, while the number of tests were limited,it is felt that the results of these carefully run tests give a good indication as to the condition of the lines in the areas wherein the tests were conducted.

This brief resume of the methods employed to ascertain the rate of flow and rate of infiltration is given to indicate, at least, the manner in which the data incorporated in this report were accumulated.

During a typical dry weather month during the past year (the month of September, 1956, being selected at random), the total sewage flow to the plant averaged 0.798 M.G.D. Of this amount the City of Sonoma supplied 0.146 M.G.D., the Sonoma State Hospital supplied 0.364 M.G.D. and the District supplied 0.288 M.G.D.

Comparing these dry weather flows to those occurring on a day in the midst of a short rainy period from the 23rd to 25th of February, 1957, the measured flows were as follows: The Sonoma State Hospital recorded 0.679 M.G.D. and the City of Sonoma recorded 1.763 M.G.D. to give a total non-District flow of 2.442 M.G.D.

The total daily flow of 2.442 M.G.D. contributed by the two non-District entities was recorded on February 24, 1957. During this same day the treatment plant pumped 5.710 M.G. of sewage. Thus, if the District flow for this particular day was based on the difference between the total plant flow and the sum of the non-District flows, it would appear to total 3.268 M.G. These figures are shown in Table A, as shown below:

TABLE A

A Typical Comparison of Dry Weather Flow to Wet Weather Flow

SOURCE OF FLOW	AVERAGE DAILY DRY WEATHER FLOW FOR SEPT. 1965	AVERAGE WET WEATHER FLOW FOR FEB. 24, 1957
City of Sonoma	0.146 M.G.	1.763 M.G.
Sonoma State Hospital	0.364 M.G.	0.679 M.G.
Apparent Dist. Flow	0.288 M.G.	3.268 M.G.
Actual District Flow	0.288 M.G.	5.80 M.G.
Apparent Total Flow	0.798 M.G.	5.710 M.G.
Actual Total Flow	0.798 M.G.	8.20 M.G.

However, as hereinbefore stated, the recorded plant flow only reflects the pumping capacity of the treatment plant. Actually, during this same day, a measurement made in the morning by means of the aforementioned manhole measuring devices showed a flow at the rate of 8.42 M.G.D. In the afternoon of that same day a flow at the rate of 8.00 M.G.D. was measured. As these measuring devices are not equipped with automatic recording mechanisms a median figure of 8.2 M.G. would seem a reasonable flow for that particular day. As only 5.7 M.G. was pumped during this period of time at least 2.5 M.G. of sewage was discharged into Schell Creek during this same interval of time.

Also, the District flow for that day would not be the apparent 3.268 M.G., as heretofore shown, but at least 5.8 M.G. (8.2-2.4).

It might be well to mention that the flows given on Table A from the City of Sonoma and the Sonoma State Hospital are daily average flows. On any given day the peak flows may be, and usually are, several times greater than the daily average flow. For example, on this same day of February 24, 1957, the City of Sonoma flow exceed a peak of 2.00 M.G.D. while the Sonoma State Hospital had a peak flow of 1.6 M.G.D.

It can be seen that during storms with intermittant rainfall, as was the case in the February 24, 1957 rain, the individual flows vary from time to time as the ground water is carried off and the differences in distances from the sources of origin to the treatment plant tend to reduce the peak flows experienced at the plant. However, when the rains are steady over a fairly extended period of time, all sources of origin build up the flow to a point where much greater peaks, lasting for greater periods of time, are experienced at the treatment plant.

The details and results of flow measurements in the other areas of the District trunk lines wherein the measuring devices are located tell a similar story. However, as was clearly observed during this past rainy season, there was a dearth of normally heavy rainfall, so that a further investigation was made to ascertain the probable present peak flows.

Two methods of carrying out this investigation were employed. The first method used was to check the records of the District for the previous year, namely 1955-56, to determine at which points in the system overflows occurred. The second method used was that of giving selected sections of line a water test to determine the maximum amounts of water that would exfiltrate from the said lines. This exfiltration figure can then be correlated to an infiltration rate, as will be described later in this report.

Following the first line of reasoning, wherein the minimum rates of flow can be determined for a section of line which experienced overflows, the minimum peak flows actually carried by these said sections were determined. The areas in the District where overflows occurred during the 1955-56 rainy season indicate a substantially greater rate of flow for that period than was experienced during the current rainy season. This finding, of course, was to be expected upon observation of the rainfall records for these two seasons.

The other method of approach to the problem of determining the present peak flows and the present possible peak flows was that of water testing the various sewer lines.

Due to the limitations of time and manpower it was deemed advisable to water test the lines in those areas showing the largest contributions of sewage during previous periods of rainfall. The photographs of the manholes in the various areas indicated large amounts of infiltration in the lines embraced by L.I.D.'s 1, 2 & 3.

As L.I.D. #3 is small in area, it was decided to water test selected lines in L.I.D.'s 1 & 2.

It should be noted that the considerable constant flows in the various District trunk lines are of a magnitude to preclude their being water tested. The District does not have the facilities to by-pass these flows to make such tests as were conducted in the L.I.D.'s.

Basically the method of water testing employed is that of plugging both ends of a run of sewer line, filling the line with water and measuring the amount of water exfiltrating from said line in a given period of time. Several refinements are, of course, necessary in the actual running of such a test, such as the selection of a section of line which can be taken out of service for the length of time required to run the test (such a test could require up to two hours to complete); the selection of a section of line composed of uniform size of pipe; and the selection of line having a minimum of connecting house sewer services.

The tests of lines in L.I.D. #1 show a definite pattern in that the rates of water exfiltration decreased steadily during successive tests of the same section of line over a short period of time (by short period time is meant a few hours, at most) This pattern follows very closely the expected behavior of such a test in that the lines tested in this area lie within trenches cut into typically rocky ground. The first tests give the greatest rates of exfiltration but as the water leaks out the pipe it raises the water level in the trench surrounding the pipe so that successive tests have less effective heads and the result is less water leakage from the pipe.

As previously stated, the number of exfiltration tests conducted were necessarily limited and, even though the tests were carefully run, the results are not incorporated in the actual analysis of present and ultimate flows as set forth in this report. The results of these tests are, however, indicative as to the magnitude of the sewerage systems infiltration, amounting to some 62,000 gallons per day per inch diameter of pipe per mile of line per twenty-four hour day for L.I.D. #2. When these infiltration figures are compared to the allowable County Standards of 250 gal/inch/diam/mile of pipe/24 hour day, the seriousness of the situation becomes apparent.

The present possible flows for the various areas of the District are shown in Figure 1, attached hereto, these flows being determined by the use of the data obtained as hereinbefore described, in the following manner:

From the various flow data and records of line surcharges and overflows of manholes and other appurtenances throughout the District the minimum present peak flows within different areas of the District were calculated. The word minimum is underscorded in order to emphasize the fact that an unsurcharged line in a collection system will permit the maximum line infiltration while a similar surcharged line will permit a smaller amount of ground water to infiltrate into the pipe, indeed, if the amount of line surcharge is of a sufficient magnitude sewage may even flow from the sewer lines to the surrounding ground.

In a like manner it is possible to deduce the minimum present peak flows from the elevations of the water surfaces in a series of manholes showing various stages of surcharge and overflow. The quantity of sewage overflowing at such points is, unfortunately, rather difficult to estimate, so the only use of such estimated overflowing quantities is to point them out as possible reasons for minor discrepancies in measured and calculated flows.

The following table TABLE B, gives the comparison of present dry weather flow to present wet weather flow in terms of both ratio of wet weather to dry weather flow and percent increase in flow from dry to wet weather. The figures from which these calculations are made are from TABLE A, herein.

TABLE B

Source of Flow	Flow (M.G.) Dry Weather	Flow (M.G.) Dry Weather	Ratio of Present Wet Weather Flow to Present Dry Weather Flow	Present Percent Increase of Flow From Dry to Wet Weather
City of Sonoma	0.146	1.763	$\frac{1.763}{0.146} = 12.07$	$\frac{1.763-0.146}{0.146} = 1{,}107\%$
Sonoma State Hospital	0.364	0.679	$\frac{0.679}{0.364} = 1.86$	$\frac{0.679-0.364}{0.364} = 86\%$
Actual District	0.288	5.80	$\frac{5.80}{0.288} = 20.14$	$\frac{5.80-0.288}{0.288} = 1{,}914\%$

The figures shown in this aforesaid TABLE B are of importance as an aid to estimating the tentative sizes of the required trunk lines required for the ultimate development of the District. It is obvious that, if the present District wet weather flow is approximately 20 times greater than the present dry weather flow and this figure has been reached in less than three years of sewerage system operation, the ratio of ultimate wet weather to dry weather flow in the existing portion of the sewerage system will in all probability be much greater than the aforesaid ratio of present wet weather to dry weather flows. Several valid lines of reasoning lead to this inevitable conclusion, but all of the reasoning can be summed up in the fact that leaking lines, whether leaking because of poor joints, broken bells, broken pipe or other causes, will certainly deteriorate under the continuous forces surrounding and acting upon them. These forces include root action, continual shifting of cracked portions of line, undermining of lines by water movement into or out of openings in the pipe, etc.

It is the recommendation of the County Sanitation Engineer that additional sections of the sewerage system be not only tested for exfiltration rates but that certain sections be excavated and a pipe length by pipe length check made to ascertain if a definite pattern of sewerage system failures and/or inadequacies can be developed which can be applied to the system as a whole to more accurately estimate the ultimate trunk line requirements of the District. Such an investigation should be made prior to the final decision on possible sizes of contemplated trunk lines.

However, in the absence of more exhaustive investigations of this nature, and based on the results of the present studies, the minimum estimate present and ultimate sewage flows and the minimum trunk lines sizes (with available slopes) to handle such flows that should be considered for realistic present estimating purposes are shown in Figure I, attached hereto. It would seem unwise to consider lines of smaller capacities at this stage of the investigation and it is entirely possible, that after further investigations as hereinbefore described, the required pipe sizes may be even greater than those shown.

II

ULTIMATE SEWAGE FLOWS

The ultimate sewage flows from the various parts of the District are composed of the sum of the possible present flows, the future flows from undeveloped areas and the infiltration to future trunk lines required to transmit such flows.

The flows from the undeveloped areas are based on infiltration rates, domestic sewage rates and peak flow factors compatible to the standards of the County Sanitation Department.

These design factors are:

Population Density

3.75 persons per house and 2.67 houses per acre = 10 persons/acre

Daily Sewage Flow Per Capita = 100 gallons

Peak Flow Factor = 1.7

Length of Trunk and Lateral Sewers Per Acre (Includes Trunk Sewers 10" Diameter and Less) = 0.040 miles

Length of House Service Sewers Per Acre = 0.030 miles

*Infiltration in Trunk and Lateral Sewers in Gallons Per Day Per Mile of Pipe for Pipe 10" Diameter or Smaller = 10,000 gallons

Infiltration in House Service Sewers in Gallons Per Day Per Mile of Pipe Per Inch Diameter of Pipe = 1,000 gallons

Infiltration in Trunk Sewers Over 10" Diameter in Gallons Per Day Per Mile of Pipe Per Inch Diameter of Pipe = 1,000 gallons

These flows are shown on the aforementioned Figure I, attached hereto.

It should be noted that the ultimate peak sewage flows necessarily determine the sizes of the lines in the collection system if said system is to be adequate for the ultimate District expansion.

III

REQUIRED IMPROVEMENTS TO DISTRICT SEWERAGE SYSTEM

The basic reason for the work and calculations in this report up to this point is to offer some basis for ascertaining the magnitude of the District improvements required to insure the development of a sewerage system capable of properly functioning both presently and ultimately.

The data collected during the course of this survey indicate that regardless of possible corrective measures to present lines, the present collection system will be

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*For testing purposes the infiltration rate is 250 gallons per day per mile of pipe per inch diameter pipe.

inadequate from as far north in the District as Madrone Road (See Fig. I).

This means that if the present area lying to the north of Madrone Road remains inside the Sanitation District and is ultimately sewered, a new trunk line must be extended from the vicinity of Madrone Road to the treatment plant.

As such a trunk line must be ultimately built, if the District is to be served by an adequate collection system, it remains only to decide on the route of the trunk line, the quantity of sewage it must carry and the cost of such a trunk line.

Taking these items up in this order, the route of the trunk line should be that which affords the most economical construction and serves most adequately the purpose for which it is intended.

As to the quantity of sewage the proposed trunk line must be capable of handling, it can either be sized to handle the ultimate peak loads, as described hereinabove, or it can be sized to handle a flow consisting of the sum of the present peak flow reduced by possible corrective measures applied to the present collection system and the calculated future flow from the undeveloped areas of the District.

The costs of the required lines are of course dependent upon the first two items, being directly tied into the location and size of the line.

The primary problem posed by this trunk line design, is whether it would be economical to take measures to correct the heavy infiltration occurring in several areas of the collection system. This problem may best be decided by an investigation of the efficacies and costs of the various methods currently used to repair leaking sewer lines.

There are at least two more or less commonly used systems of sewer line corrections available in this part of the State. The first system employes the use of a chemical sealant that swells up in the defects in the pipe and in the defective pipe joints to effect a seal. The second system is one wherein grout of various types is mechanically squeezed through the openings in the defective pipe and pipe joints to seal such openings.

The comparative costs of applying such methods of treatment to the areas requiring same are shown in Table I.

TABLE I

COMPARITIVE COSTS OF VARIOUS METHODS OF TREATMENT FOR LEAKING SEWER LINES

Area to be Treated	Estimated Cost of Corrective Measures (1) Chemical Treatment	(2) Grout Treatment
L.I.D. #1	$ 84,110.00	$155,240.00
L.I.D. #2	47,660.00	102,340.00
L.I.D. #3	4,300.00	9,230.00
Total	$136,070.00	$266,810.00

The main deterrents to recommending the use of either of these pipe sealing methods are:

1. Lack of resistance to root growth.
2. Insufficient or no guarantee as to results of treatment.
3. Excessive participation of District forces during treatment.
4. Impossibility of treating trunk lines.
5. High cost of treatment.

The first deterrent, as hereinabove shown, would make the line treatment a rather costly venture of limited life. Photographs taken in various manholes show extensive root growths within the collection system, and the District this past year has had to uncover and repair several sections of line completely plugged with root growth. As neither of the two systems of sealing lines herein under consideration would prevent the reentrance of roots, even if said roots were cut out prior to treatment, it would be but a matter of time before the system would return to its pre-treatment state.

The Company offering the chemical sealant method guarantees the work for one (1) year. The Company employing the grouting method gives no guarantee on their work, in fact this Company frankly states that the results will range anywhere from good to poor, without any clearly defined reason for either result.

In view of the limited useful life of the possible corrective treatment to the lines in question, and in view of the fact that a parallel trunk line would have to be extended from the treatment plant to Madrone Road regardless of whether any lines were treated or not, it would seem logical to size the required trunk line to handle all flows in excess of those capable of being handled by the existing lines.

Again shown on Figure I are the proposed trunk line and interceptors required to provide for the ultimate District peak flows.

Included on said Figure I are the data for the proposed trunk line where it is sized to sewer the lands adjacent thereto but presently outside the District. In the event this area desired sewer service a single trunk line would serve both the area in question and the District. This, of course, would prove the most economical way to serve this outside area and the aforesaid information shown in Table II is for purposes of cost comparison.

TABLE II

Cost of Trunk Lines from Treatment Plant to Madrone Road

Trunk Line Capacity	Estimated TotalCost *
1. Capacity for area within present District	$1,177,000.00
2. Capacity for area within present District plus outside area as shown in Figure I	$1,537,000.00

*Total cost includes R.O.W., Legal & Engineering

It might be added at this point in the report, that the District area lying to the north of Santa Rosa Avenue, east of Arnold Drive, south of Madrone Road and west of Sonoma Creek, is presently so far removed from the present trunk line that there is little likelihood of the area being sewered at any time in the near future. Many of the property owners in this area are requesting permission to withdraw from the District because of this lack of access to sewer lines.

To provide a trunk line from the east side of Sonoma Creek to serve this aforesaid area would cost some $103,000.00, and as can be seen from Figure I, any proposed trunk line running from the treatment plant to Madrone Road would eliminate the need for this limited area trunk.

Before leaving the subject of trunk line requirements, two factors bearing directly on the ultimate flows over which the District has no control, should be considered.

The first of these factors is the City of Sonoma flows. Nothing in the existing City of Sonoma - District Agreement limits the amount of sewage which the City can contribute to the District trunk line and treatment plant. For the purpose of this review the ultimate maximum peak flow from the City is considered to be 2.7 M.G.D. This assumption is based on the limiting sizes of the City lines tributary to the present District trunk line. However, it is entirely possible for the City to annex additional territory and increase the capacity of their lines leading to the District trunk and so provide virtually unlimited quantities of sewage to the District sewerage system.

The City of Sonoma, last year, went so far as to propose setting up a fund to finance the paralleling of the City outfall line to the confluence with the District trunk, as hereinbefore described.

The other factor largely beyond the control of the District is that of the peak sewage flows emanating from the Sonoma State Hospital.

The State Hospital flow meter is capable of recording a maximum of 2.0 M.G.D. so that any flows above this figure are not recorded.

From photographic evidence of manhole surcharges to points of known elevations within the manholes and of siphon overflows it is evident that the trunk line below the State Hospital has carried nearly 4.0 M.G.D. of sewage during certain peak flows. However, by the terms of the existing District - Sonoma State Hospital Agreement the ultimate maximum daily average flow that the Hospital can contribute to the District sewerage system is 650,000 gallons per day and it seems reasonable to assume that the Hospital sewerage system will have to have some corrective measures applied to it to keep within the said allowable maximum daily flow. This corrective work should insure a limitation of the ultimate peak flows from this source to somewhere around the present peak flows. This premise has been used in the estimation of the ultimate peak flow from this area, all as shown in Figure I, shown herein.

Another improvement which should be considered in this report is that of installing manholes required in the present system. Presently installed manholes are, in a good many instances, of such a distance apart that it is not possible to free the lines of obstructions when the lines become plugged. Some manholes are as far apart as 1400 feet, while the maximum practical distance between manholes for proper maintenance purposes of sewer lines is in the neighborhood of 350 feet. Beyond this distance the torque required to rotate the cleaning equipment is such that said equipment will break even before meeting an obstruction.

Already the District has had to pay in excess of $100.00 per individual excavation to gain access to plugged lines and to permit the entrance of the rodding equipment necessary to unplug the line.

As shown by the photographic records of the District lines and as indicated by the District maintenance records, root growths are gaining a foothold to the point where the number of line stoppages are steadily increasing.

Thus, beside being required for the normal preventive line maintenance, the manholes will be progressively more in need due to the aforesaid root problem. The location and estimated cost of these manholes are shown in Table III, as follows:

TABLE III

Location and Estimated Cost of Required District Manholes

Required M.H. Location	Number of Manholes Required	Estimated Manhole Costs
Trunk Line I	45	$ 17,920.00
Trunk Line II	16	5,550.00
L.I.D. I	67	18,410.00
L.I.D. II	67	21,000.00
L.I.D. III	4	1,080.00
Total	199	$ 63,960.00

It should be emphasized that the manholes, as shown in Table III, must be constructed regardless of any other work done to the District sewerage system.

So far the discussion of required sewerage system additions or alternations has dealt with the collection system and the trunk system to the plant. However, it should be realized that the present outfall line from the treatment plant to the point of discharge in Schell Slough is not capable of handling even the present plant pumping capacity during periods of high tide.

At periods of high tide a flow in excess of a 5.0 M.G.D. rate will cause the outfall manholes at the treatment plant to overflow. With a free discharge the outfall would carry, if the plant had the pumping capacity, a flow at the rate of 7.6 M.G.D. before overflowing of the treatment plant manholes occurs.

The maximum flow to the treatment plant through the present trunk lines and by the use of the hydraulic control structure could amount to some 9.0 M.G.D. if the plant had the pumping capacity to move this quantity of sewage. Thus the outfall capacity would have to be increased by some 4.0 M.G.D. to enable the outfall line to transmit to the point of outfall the present maximum flow that could possibly be conveyed to the plant.

This could be accomplished by the installation of a parallel outfall line or could far more cheaply be done by pressurizing the present line and increasing the pumping capacity of the plant. The former method would cost an estimated $225,000.00 as against some $62,000.00 for the latter method.

From Figure I it can be seen that the ultimate outfall line will have to be of far greater capacity than that required to handle the present possible plant flows.

The outfall line for the ultimate flows should be a gravity line to eliminate the dependence on pumping for emergency by-passing of the plant. The estimated cost of the outfall line, first as calculated for ultimate peak flows from the District as now constituted and secondly for ultimate peak flows from the District plus the area which could be served by a new trunk line, are shown in Table IV.

TABLE IV

ESTIMATED OUTFALL LINE COSTS

Trunk Line Capacity	Size	Estimated Total Cost *
1. Capacity for Area within present District	48"	$ 353,000.00
2. Capacity for Area within present District plus outside Area as shown in Figure I	54"	$ 392,000.00

* Estimated Costs include construction, R/W and Legal and Engineering.

The costs shown in Table IV do not include the costs of grit chambers, metering devices, head gates and appurtenant equipment which would be required in conjunction with a new outfall line. These items would be properly included in the overall design of the treatment plant expansion, and no attempt has been made to include this phase of work and planning in this report.

From the magnitude of the ultimate flow figures as shown in Figure I it can readily be understood that some program must be initiated to provide for the expansion of the treatment plant to meet the increased plant flows.

There are, however, aside from the future plant needs, two plant improvements presently required. The first of these is the requirement for more digester capacity, and the second is the need for more sludge drying space.

At present the plant has but one covered digester, and the digester capacity is not equal to the present loads imposed on it.

The minimum expenditure for the correction of the digestion problem would be in the neighborhood of $25,000.00. This amount would be sufficient to either supply a second digester cover with heat exchanger or provide for the installation of a catalytic reduction process in the existing digester.

The latter of these two corrective measures would give a greater increase in digester capacity than the former method for approximately the same expenditure of money.

Due to the limited period during which sludge can be dried it will be necessary to increase the area of the present sludge drying beds. The estimated cost of doubling the present dying bed size is $11,500.00.

Several other phases of the required District improvements should be mentioned in this report. As can be seen on Figure I there is a presently unsewered area at the northernmost end of the District. Originally this area was to have been sewered by means of a trunk line extending north of the State Hospital to Glen Ellen. In the course of events, however, this line was never completed.

The cost of constructing this line, hereafter called the Glen Ellen Trunk, is an estimated $141,000.00. This figure includes Engineering, Legal and Right of Way costs pertaining to this trunk line.

The only property owners that would be directly benefited by the construction of the Glen Ellen trunk line in the event that a collection system was not designed and constructed concurrently with the proposed Glen Ellen trunk line, would be those whose properties were adjacent to the said trunk line. These few fortunate property owners could then legally connect directly to the trunk line after making a payment of $150.00 to the District, all as set forth by Resolution, dated February 15, 1955, of the Board of Directors of the Sonoma Valley County Sanitation District. The farther removed properties would then have to finance their connections in the best way possible.

The equitable way to sewer the area would be to form a local improvement district (L.I.D.) blanketing the whole Glen Ellen area with the exception of some inaccessible lands which should be excluded from both the proposed L.I.D. and the Sanitation District. In this way all the property owners would share in the construction of a collection system, paying proportionately to the availability of the sewer to all portions of their property.

Such a proposed L.I.D. would cost an estimated $255,090.00. This figure includes the estimated engineering, legal and right of way costs as well as the actual construction costs.

CONCLUSION

There has been no effort in this report to make any recommendations as to specific corrective measures and required sewerage system construction to be done in the District. Final planning as to such measures can only be made subsequent to the adoption by the District Board of Directors of a policy to be followed in this matter.

This policy should include, among other things, the course of action to be followed by the District in matters of:

1. Future annexations to District.
2. Exclusion of certain territories from District.
3. Remedial measures on District sewerage system.
4. Future construction on collection system, treatment plant and outfall line.
5. Methods of financing proposed work.

When such a policy is developed the District will have the guide lines within which it will be possible to develop to its intended status of present and ultimate benefit to those areas concerned in an orderly and efficient manner.

RECAP OF
SONOMA VALLEY COUNTY SANITATION DISTRICT
ESTIMATED COSTS OF IMPROVEMENTS

Location or Area	Present District Boundary	Increased District Boundary	Remarks
Glen Ellen Trunk	$ 141,000.00	$ 141,000.00	
L.I.D. Glen Ellen	255,000.00	255,000.00	
Manholes	63,960.00	63,960.00	
Parallel Trunk Line	1,177,000.00	1,537,000.00	
OUTFALL LINES			
" " 48"	353,000.00		
" " 54"		392,000.00	
	$1,989,960.00	$2,388,960.00	
PRESENT TREATMENT PLANT WORK			
1. Digester Cover	25,000.00	25,000.00	
2. Sludge Beds	11,500.00	11,500.00	
	36,500.00	36,500.00	
PLANT EXPANSION	To be determined	To be determined	

MISCELLANEOUS COSTS	
1. Trunk Line East of Arnold Drive	$103,000.00
2. Sewer Line Treatment or Repair (Seal-Off Infiltration)	
1-Chemical Treatment	136,070.00
2-Grout Treatment	266,810.00
3. Temporary Outfall Line	
1-Pressurized	62,000.00
2-Gravity (Parallel)	225,000.00

Board of Directors
Sonoma Valley County Sanitation District
Court House
Santa Rosa, California

Re: Report No. 2 on the Sonoma Valley County Sanitation District

Gentlemen:

The following report is made regarding the status of the investigation into the causes of the high winter flows within the subject District sewerage system. A report of this nature is also required of the District at this time by the State Regional Water Pollution Control Board, all as set forth in the Regional Water Pollution Control Board Resolution No. 229, dated November 15, 1956.

The subject District's Board of Directors authorized the County Sanitation Engineer, upon his recommendation, to continue the investigation of the District sewerage system with the purpose of determining with all possible accuracy the causes of the high flows within the said sewerage system during periods of wet weather.

It was apparent from the data compiled during the winter of 1956-1957 that a large proportion of the surplus water in the District sewerage system had its origin in that portion of the collection system encompassed by Local Improvement Districts Nos. I, II, and III. On this basis the present investigation was logically concentrated up those areas, and the nature of this investigational program can be outlined as follows:

1. Excavation of certain lines throughout the several Local Improvement Districts for purposes of observation and tests of such exposed lines.

2. Removal of typical pipe sections from lines exposed by excavation in order to run individual leakage tests on such pipe sections.

3. Sectioning of pipe and joints from pipe removed from excavated sewer lines to ascertain jointing methods used in laying pipe.

4. Photographing portions of the District sewerage system during various periods of wet and dry weather to establish patterns of sewage and storm water flows.

5. Design and construction of an automatic recording measuring flume to determine the total trunk line flows upstream from both the treatment plant and the Splude Road overflow. By this means it will be possible to calculate the amount of overflow in the aforesaid Splude Road structure.

Reviewing in greater detail the individual parts of this investigational program, as listed heretofore, one of the most extensive undertakings was the excavation of certain sections of the collection system in the various Local Improvement Districts.

As to the manner in which the selection of lines to be excavated was carried out there was no effort made to isolate and excavate sections thought to exhibit the greatest rate of leakage. The only consideration given to the selection of such sections of line was the necessity of maintaining traffic in the working area. Thus, sections of line were exposed where the neighborhood traffic could either be by-passed around the work or else the street wherein the work was required could be entirely closed.

There was only one section of line exposed where a water test had been given to it prior to excavating same. This section was tested in the belief that a portion of it under a creek had collapsed, this belief being brought about by the inability of District forces to fill the line with water. However, examination of the line subsequent to excavation indicated no structural failure of the pipe. The water was merely leaking through the joints faster than it could be introduced into the pipe from a water tank truck.

The method used in exposing the sewer pipe was that of carefully removing the dirt from the ground surface to a point approximately three inches over the top of the pipe bells by means of a back hoe and then removing the remaining dirt over and around the pipe joints by means of hand digging. The pipe remained firmly in place and with the exception of the area surrounding the joints there was no disturbance of the pipe bedding.

Approximately six joints in the sewer line were exposed at each excavation site, and following such an excavation a test was run on the exposed line.

The line was tested by plugging it off at the nearest downstream manhole and introducing dye and water into the nearest upstream manhole or cleanout. The pipe and joints were then observed for signs of leakage, this leakage being readily apparent due to the fluorescent dye employed.

It should be noted that the internal water pressure to which these lines were subjected was very low, in most cases amounting to but a few inches of water pressure.

The enclosed photographs, numbered 1 - 6 inclusive, show typical results of tests as heretofore described.

Photograph No. 1 shows a section of pipe as it looked before the introduction of testing water and dye into the pipe while Photograph No. 2 shows the same section of pipe a few minutes after the water and dye were placed therein. It can be noted that the holes excavated around the bells were filling up with water within minutes after the start of the test. This leaking water came entirely from the pipe joints as the body of the pipe was in sound condition.

Photographs Nos. 3, 4 and 5 show other views of joints exhibiting types of leakage which proved typical throughout this phase of the investigation.

A different type of leakage is illustrated in Photograph No. 6. This type of leakage was commonly observed in the manholes downstream from the lined under test. Two things can be noticed in this picture, the first of which is the leak in the manhole base as indicated by the arrow drawn on the picture. In this instance the dyed water leaked out of the pipe being tested, ran along the pipe to - and under - the downstream manhole and from there entered the manhole through a flaw in the base of same. In a like manner, the leaking dyed water is shown entering the other upstream sewer line not under test. This, of course, indicates that the water leaking from the line under test entered the unplugged line through leaking joints and/or cracks and then found its way into the manhole.

A summary of the methods and results of this portion of the investigational program can be itemized as follows:

1. A minimum of two sections of line were uncovered in each Local Improvement District for testing purposes and the lines could be considered as being selected at random, for all practical purposes;
2. Fifty-eight pipe joints were tested in place, all of which leaked when subjected to minor pressure;
3. An average of one piece of pipe in each section of pipe excavated was found to have been broken during or after installation;

4. Roots were found in the majority of pipe joints so exposed. Photograph No. 7 shows a typical example of root growth in a joint. This particular joint was nine and one-half feet deep and is of interest in that it indicates that roots are presently at least that far below the ground surface.

It was obvious from the results of the tests run on the excavated sections of pipe that the main source of infiltrating ground water entering the sewerage system was, and is, the leaking pipe joints. In order to ascertain to what extent such joints were leaking it was necessary to remove sections of pipe and run leakage or exfiltration tests on certain individual joints therefrom. The use of the term "certain individual joints" is advisedly used in this case as it was found that a good share of the joints being removed would merely pull apart at the slightest pressure and that regardless of the extreme care of handling only a select few joints could be salvaged for further testing. In this regard it should be understood that the joints individually tested represent the better joints as found in the exposed lines as the poorer joints would not hold together long enough to have such tests made on them.

The joints were tested in such a manner and two tests were run on each joint to insure the determination of a more accurate leakage rate. The average leakage rate determined in this manner amounted to some 27,982 gallons per day per inch diameter of pipe per mile of pipe. Comparing this measured leakage rate to the requirements of some of the specifications for the original installation of these lines indicates the disparity between the actual leakage rate and the maximum allowable leakage rates. The latter rates (required by the specifications) are in one case a maximum of 400 gals/day/inch diameter/mile of pipe and in another case 1000 gals/day/inch diameter/mile of pipe.

Table I, herein, shows the rate of infiltration that could be expected within the three Local Improvement Districts if this average infiltration rate was applied to the collection system street laterals.

TABLE I

EXPECTED INFILTRATION FROM L.I.D.'s I, II & III WHERE INFILTRATION RATE IS ASSUMED TO BE 27,982 GALLONS/INCH PIPE DIAMETER/MILE OF PIPE.

Area	Pipe Size (Inches)	Length of Pipe(Feet)	Length of Pipe(Miles)	Infiltration Per Day
L.I.D. I	6	66,598	12.613	2,117,627
	8	9,888	1.873	419,283
L.I.D. II	6	35,957	6.810	1,143,347
	8	8,086	1.531	342,725
	10	2,139	0.405	113,327
	12	6,750	1.278	429,132
	15	733	0.139	58,342
L.I.D. III	6	3,951	0.748	125,583
		TOTAL =		4,749,366

= Approximately 4.75 Million Gallons/Day

The figures shown in TABLE I should be taken only for what they represent, namely, a theoretical infiltration flow based on the average leakage rate of pipe removed from District lines. Modifying the total infiltration rates shown in said TABLE I are:

1. The pipe joints tested were far better than the average joint exposed.

2. The average head under which these joints were tested was 1.79 feet while the average depth from pipe invert to ground surface throughout the three Local Improvement Districts is 7.02 feet so that the ground water over the pipes during the rainy season is, in all probability, greater than the aforesaid 1.79 feet average testing head.

3. Root growth was noted in all areas tested. Roots have entered pipe joints as deep as nine and one-half feet

from the ground surface. The continuing root growth will undoubtedly cause more and more pipe joints to fail as the roots continue to develop.

4. The presence of approximately one cracked piece of pipe in six suggested that the flow of sewage into and out of such cracks will probably erode the soil surrounding such cracks, thus leading to the ultimate collapse of the pipe in these areas as the supporting strength of the soil is lost from around the cracked joints.

5. No ground water infiltration into the District sewerage system from house service lines or trunk lines within areas under investigation are reflected in TABLE I, and there is no reason to doubt that a substantial amount of extraneous water enters the system from both of these sources.

It is of interest to note that during one rainy period during the 1956-57 investigations* the District flow alone measured 5.8 M.G.D. for a particular day. If the total of 4.75 M.G. shown in TABLE I were added to the District daily dry weather average flow from June to September, inclusive, for the year 1956 and 1957, said dry weather average being approximately 0.346 M.G.D., the total flow would be some 5.10 M.G.D., the latter figure again not including trunk line or house service infiltration figures. It is of further interest to note that 1956-57 was a relatively dry winter with consequent lower ground water levels.

Subsequent to the water testing of the various individual pipe sections the sections having the sturdiest joints were sectioned by means of a masonry saw to provide data on the methods employed in the construction of the pipe joints.

A typical excerpt from one of the specifications for a Local Improvement District, said specification pertaining to "Cement joint bell and spigot sewer pipe laying"**, reads:

* See Sanitation Engineer's Report of June 7, 1957, page 13

** Specifications and Contract Documents for the Construction of a Sewage Collection System, Local Improvement District No. 3

"The pipe shall be centered with the oakum specified hereinbefore. Care shall be taken that no loose ends or fibers of the caulking material are allowed to protrude from the joint and that four-fifths (4/5) of the depth of the socket is left for the joint mortar. ---------

"As soon as the gasket is caulked and the pipe secured against movement, the remaining annular space in the pipe bell shall be filled by caulking the mortar specified hereinbefore, with a hardwood stick".

Photographs taken of the cross sectioned pipe joints are in the process of being enlarged, and, if completed in time, will be included in this report. These photographs, if obtained in time, will be numbered 8 - 14, inclusive.

In lieu of the photographs of the sectioned pipe, attention is drawn to photograph No. 7, included herein. This photograph is typical of the joints encountered. The spigot end of the pipe shown was separated from the bell end of the adjoining pipe by merely pulling the two apart by hand.

The invert side of the pipe is towards the observer and it may be noticed that the only mortar present in this area was a fillet between the spigot and bell. The mortar that is present along the sides and top is a non-compacted mass which slants from the fillet to a point completely to the end of the spigot, indicating the absence of any caulking material in the joint. Indeed, in only one joint of all the joints replaced, repaired, tested and sectioned was there any indication of oakum or jute present.

Photograph No. 7 also shows the typical presence of mud and roots in the annular space between the bell and spigot.

Very little bond was evidenced between the mortar and/or pipe bells or spigots and under exfiltration tests water oozed right through the mortar of the joints, even where the mortar looked to be in a satisfactory condition.

Besides the direct testing and removal for inspection of various pieces of the sewerage system, as hereinbefore described, the method of photographing portions of the District system, as instituted during the 1956-57 season, was continued. These photographic records are valuable inasmuch as they furnish a lasting record as to flow patterns during dry and wet weather periods.

No significant variations from the past seasonal flows have been observed so far this year.

Another step in the present investigation has been the design and construction of a Palmer - Bowlus type measuring flume in the trunk line upstream from both the Splude Road overflow structure and the District sewage treatment plant.

This measuring device has been equipped with a recording meter so that total flows in this portion of the trunk line will be recorded. In this way, knowing the amount of sewage the plant has handled and knowing the total flow in the trunkline above both the plant and overflow structure, it will be possible to determine the flow from the Splude Road overflow structure into the adjoining creek.

This recording device is now in operation and is in the process of being calibrated.

From the data compiled from the present investigation, a summary of which has been included herein, I am satisfied that the major portion of the infiltrating water entering the system during period of high flow is due to leakage of ground water into the lines through poorly constructed street lateral sewer line joints.

This conclusion was at least indicated from the 1956-57 survey in the study of the relationship of rainfall to high District flows: The report to the District Board of Directors, dated August 26, 1957, contained the following:

> "A total of approximately five (5) inches of rain must fall in the area encompassing the Sanitation District before the District flow (not to be confused with the total plant flow) is greatly affected, and
>
> After the ground has become well saturated the District flow increases to and remains at the rate of flow substantially higher than the normal dry weather flow."

The next question is, of course, how to alleviate this infiltration and, at the earliest time possible, reduce the fluid volume to a point where overflows will be eliminated.

Report No. 1, mentioned two methods of treatment neither of which have been proven.

Concurrently with our investigation, as outlined herein, we have been conducting some experimental test, which tests, while not at present conclusive, indicate possibilities which justify continuance.

Yours very truly,

MARSHALL WALLACE
SANITATION ENGINEER

Board of Directors
Sonoma Valley County Sanitation District
County Administration Center
Santa Rosa, California

Report on the work done between June, 1958 and June, 1959, to develop a satisfactory method of sealing leaking sewer lines and appurtenances for the Sonoma Valley County Sanitation District

Gentlemen:

As you are well aware, the condition of the sewerage system in the Sonoma Valley County Sanitation District is such that extensive and prolonged sewer overflows occur during the rainy period of the year. In order to prevent such overflows one of the three following procedures, or some combination of these procedures, must be carried out, these procedures being:

1. Construct trunk sewer lines of adequate capacity to remove the combined infiltrated water and sewage from the overloaded collection system. This trunk line construction will also require that there be an increase in the sewage treatment plant facilities and outfall capacity therefrom to adequately handle, treat, and remove the increased sewage and infiltrated water flow from the collection system.
2. Remove and rebuild, in its entirety, the District sewage collection system.
3. Find some method of adequately sealing the leaks in the present sewage collection system to eliminate the extraneous water therefrom.

The first two of these said procedures, and the estimated cost of each, have been discussed at some length in previous reports, so this report will deal primarily with the abovementioned third procedure, that of sealing the leaks in the existing sewerage system.

As mentioned in my Report of June 7, 1957, entitled "REPORT ON THE SONOMA VALLEY COUNTY SANITATION DISTRICT SEWERAGE SYSTEM", there are commercially available two types of sewer line sealing processes, but, as noted in said prior report, the main deterrents to their use are:

1. Lack of resistance to root growth.
2. Insufficient or no guarantee as to results of treatment.
3. Excessive participation of District forces during treatment.
4. Impossibility of treating trunk sewer lines.
5. High cost of treatment.

A review of the known problems to be surmounted by any sealing process, presently used or not, and a review of the causes of the ground water infiltration into the District sewerage system (This latter phase of the investigation was covered in my REPORT NO. 2 ON THE SONOMA VALLEY COUNTY SANITATION DISTRICT, dated December 20, 1957) stongly indicate that in all probability the only way to economically attack the leakage problem in sewer lines would be by sealing the lines from outside the pipe. This method is in direct contrast to that employed by the two abovementioned commercial types of sewer line sealing processes.

The main advantages of externally sealing lines over the internal sealing method would be:

1. No necessity to by-pass sewage around sections of lines to be treated, and
2. No necessity of excavating the street laterals at very close intervals in hilly terrain to enable the sewer lines to be plugged in such a manner that houses adjacent to such sewer lines will not be inundated by sewage surcharging said lines under treatment.

The former advantage is considerable, as it is almost economically impossible to by-pass the flow from anything but the smallest sewer lines where the manholes in same are closely spaced.

The latter advantage can be understood when it is realized that to prevent the flooding of houses adjacent to sewer lines being surcharged with sealants, where the sealing is being done in hilly terrain, requires the line to be plugged at very close intervals. To plug the line, except where a manhole is located, requires the line to be unearthed at each point of plugging, and this cost is considerable for any type of terrain other than level ground.

Thus, with the goal of developing a method of externally sealing sewer lines and appurtenances, work was started on the project shortly before June, 1958.

A summary of the experimental work along with pertinent observations and conclusions derived from this project are hereinafter given in chronological order:

The prior tests on the undisturbed District sewer lines, the prior excavations of - and exfiltration tests on - the sewer lines in the various areas embraced by the Sanitation District, and the prior removal and sectioning of the sewer pipe removed from said excavations, all indicated that the primary and major cause of the excess water in the District sewerage system was the faulty jointing of the sewer pipe making up the collection system. On the basis of this information it was believed that a sealant could be introduced near the line in such a manner that it would travel along the voids under the pipe, surround and enter the faulty joints through the voids surrounding the joints, and, upon solidifying, not only prevent ingress of ground water into the joints but limit the travel and access of such water along the pipe line itself.

The first attempt to ascertain the practicability of such a sealing process was made on approximately 229 feet of six inch clay sewer line on Davidson Street, in El Verano, a portion of the District collection system. In this case the sealing was done by placing applicators in the ground adjacent to the sewer pipe and sealants were subsequently introduced therein. One half of this line was treated with a hot (360 - 380° F) sealant of air-blown asphalt introduced at approximately 50 pounds per square inch pressure (50 p.s.i.) while the other half of the line was treated with a sealant of asphaltic - emulsion (RS-1) applied at a high but unknown pressure.

A water test on this line made prior to the aforesaid trestments showed an average leakage rate of some 30,850 gallons per day per inch diameter of pipe per mile of pipe (gal/day/inch/mile). Similar tests after treatment showed an average leakage rate of some 12,130 gal/day/inch/mile, a sizeable but far from complete reduction of pipe leakage.

Subsequent excavations of this line on Davidson Street clearly indicated that:

1. High pressure application of sealant would not give the desired results, and
2. The cold asphaltic - emulsion was as satisfactory, cheaper, and far safer to use than the hot air blown asphalt.

The high pressure application of both types of sealants resulted in the rupture of the soil in a vertical plane parallel to the sides of the trench, and this fissure allowed the sealants to rise to the ground surface as well as progress in a more or less random course along the sewer pipe. Where the sealants came into contact with faulty joints or cracked pipe it rather effectively sealed same, in fact, as the abovementioned figures show, the leakage rate was reduced approximately sixty percent (60%).

On the strength of the results of the Davidson Street tests a further test was made on approximately 95 feet of six-inch clay sewer line on Fifth Street, Boyes Springs. Again the applicators were carefully installed next to the sewer pipe, a rather slow and "ticklish" operation involving the determination of the exact location of the sewer line by means of a metal pipe detecting instrument activated by steel sewer rods inserted inside the sewer line under test.

The sealant used was a cold asphaltic-emulsion of the type used in the Davidson Street experiment, and it was applied under a low pressure not exceeding 15 p.s.i.

The water test of this short section of line made prior to sealing showed a leakage rate of some 696,000 gal/day/inch/mile, a rate some twenty times greater than that leakage rate of the Davidson Street sewer prior to the sealing tests on that line. Quantitywise, the sealing treatment on Fifth Street reduced the leakage approximately 153,000 gal/day/inch/mile of pipe, but the total remaining leakage after sealing was some 543,000 gal/day/inch/mile, a rather tremendous figure which clearly indicates the magnitude of the leakage problem facing the District.

Again the treated line was excavated to determine what had occurred during the sealing tests and to assess the value, if any, of the procedure to ascertain if the sealing tests should be continued or abandoned. The excavation of this section of treated line brought forth a fact not evidenced in the previous Davidson Street tests, namely, that the asphaltic-emulsion would not progress satisfactorily along the voids without being under pressure, and, being under pressure, would not necessarily travel along the voids adjacent to the pipe but rather would take the path of least resistance regardless of where that path might lead.

This latter test was obviously the end of the sealing program unless some satisfactory method of controlling the action of the sealant was devised, and no ready answers to the questions posed by these problems were forthcoming.

It was then decided, for the sake of more flexibility and accessibility in testing, to construct a short length of poorly constructed sewer line approximating in quality of construction that found in the District sewerage system. Such a section of line was constructed at the South Park County Sanitation District yard in Santa Rosa. Here extensive testing was begun in July of 1958 to determine if any single asphaltic sealant, or combination thereof, would meet the special requirements desired.

After many tests and many partial or complete failures it was found that a primary gravity application of a slow curing "cut-back" asphalt, such as SC-1 would prepare the soil particles in such a way that a secondary application of an asphaltic-emulsion would not initially "break" when applied, but rather would follow the path of the path of the primary sealant through the voids under and around the sewer pipe in an apparently satisfactory manner. The operating head used on the applicators during these tests was obtained solely by the gravity head of the sealants in containers mounted either at ground level or a few feet above the ground. This gravity feed circumvented the faults resulting from pressure feeding, although the success of the application depended on the correct preparation of the soil by the use of the primary sealant.

The tests in Santa Rosa were carried out in an adobe type soil and it was felt that if the sealing process under development would work in that type of soil it would work in any soil type. Thus, in October of 1958, another test was initiated in the Boyes Springs area, on Arroyo Avenue, employing the techniques developed in

Santa Rosa. This new technique consisted of:

1. The applicators were installed, not as previously installed alongside the sewer pipe, but merely in the original trench area over the sewer pipe with the lower end of the applicator approximately ten inches (10") above the top of the pipe. This type of applicator installation greatly simplified this phase of the work, for no exact determination of the location of the sewer line was necessary and no particular caution had to be practiced to avoid damaging the said sewer lines.

2. After installation of the applicators a short, sharp jolt of the primary sealant was introduced into the applicators at pressures of from 50-60 p.s.i. This pressure "jolting" was found necessary to split the type of impervous soil found in the hilly areas of Boyes Springs. As soon as the pressure dropped in the applicator line - and the time involved in this procedure was measured in seconds - the pressure application was immediately halted.

3. The primary sealant, after the pressure "jolting", was introduced by gravity feed from 50 gallon drums mounted on wooden cradles which in turn rested on the ground to one side of the road in such a manner as to be out of the way of vehicular traffic.

4. After sufficient primary sealant was introduced the secondary asphaltic emulsion was applied through the same applicator and in the same manner as was the primary sealant, however, no initial pressure was used in this stage of treatment.

The results of this first test on Arroyo Avenue, as determined by photographs inside the pipes (very limited coverage from these photos inside the six-inch line, but details were quite good), and later by excavating the pipe, indicated that there was some reasonable hope of success by means of this type of external sealing process. In fact, it was felt that a subsequent test should be made on a longer piece of sewer line to ascertain the approximate amounts of material required for a given length of line. To determine such answers a 265 foot length of six inch sewer line on Arroyo Avenue along with some 100 feet of four-inch house service sewers were treated early in April, 1959.

You gentlemen observed certain exposed sections of this line on May 11, 1959, and as explained at that time, several more important facts and techniques were learned from this trial. These new facts and techniques pertain to the length of travel of sealants; effects of dry soil on sealants; effect of wet soil on sealants; the importance of sealing the house service sewers (in most cases the originally installed house service sewers were in even worse shape, if possible, than the street laterals); techniques for plugging large openings in the sewer lines; and many other items upon which the success of such a venture depends.

The final proof of such a line sealing program is the actual reduction of ground water infiltration into the sewerage system, and we have proposed to treat approximately one and one-half miles of badly leaking sewer line in the Boyes Springs area during the latter part of this summer and during the fall prior to the winter rains. By comparing the actual winter flows in the treated section of sewer line with the photographic records of past winter flows - and past dry weather flows - the final decision as to whether to initiate a full scale sealing program can be decided by your Board.

As a suggestion, I believe that the results of this sealing process, to date, warrants a thorough investigation by the County Counsel into the patentability of the pipe sealing process hereinbefore described. A cursory survey of the possibility of procuring such a patent indicates that such an effort, as aforesaid, should be made to possibly enable the District to profit by the work done by the County Sanitation Department.

It is hoped that the above discussion will somewhat clarify the present status of this Department's efforts to find some economical and practical solution to the admittedly difficult and expensive problems facing the Sonoma Valley County Sanitation District. As previously mentioned in my prior reports, the alternative to a practical sealing program is the beforementioned construction of either or both of a new collection system or trunk sewer line system. In the light of these possible expenditures it is felt that the time and effort expended to date on this pipe sealing project was - and is - justified.

Sincerely yours,

MARSHALL M. WALLACE
SANITATION ENGINEER

December 23, 1959

Board of Directors
Sonoma Valley County Sanitation District
Court House
Santa Rosa, California

Gentlemen:

The Sanitation Department is currently conducting sewer line sealing tests on the Sonoma Valley County Sanitation District sewerage system to ascertain the practicability of externally sealing leaking sewer lines against the infiltration of ground waters.

As I have mentioned in previous reports to this Board of Directors, the alternative courses of action that must be taken in the event no practical and economical method of line sealing is found will consist of either rebuilding the present system or providing new trunk lines of greater capacity, along with increasing the treatment plant capacity, or some combination of these two courses of action.

In view of the seriousness of the situation, coupled with the request of the State Water Pollution Control Board for a written report from your Board regarding District progress in alleviating the sewage overflows from this sewerage system - said report to be submitted prior to January 1, 1960 - a short review of the District sealing work is given herein.

I had refrained from submitting such a report until a sufficiency of rain had fallen in the Sonoma Valley area to test the efficacy of the sealing method employed, however, it appears doubtful if enough rain will fall in the next few days to warrant any further delay in this matter. In lieu of the required rainfall for testing purposes a considerable quantity of colored water (approximately 800 gallons) was introduced into the ground over the sewer line at a location exhibiting a high leakage rate prior to the sealing tests. The results of this test indicated a good degree of sealing had been obtained in this particular area, although no other conclusions could be - or should be - drawn for the other areas wherein the line sealing was attempted.

A brief review of the sealing work to date indicates that a total of some 2,850 feet of line has been treated. Of this amount approximately 2,210 feet is street lateral sewers and the remaining 640 feet is house service sewers running from the street laterals to the property lines of property adjacent to the street lateral sewers. This work was done by a two man District crew aided by one man from the South Park County Sanitation District. These men used simple hand tools, many of which were fabricated for a particular job, and the mechanized equipment consisted of one dump truck with a water tank mounted thereon and an air compressor with hand air tools. Obviously, the sealing work could be greatly expedited by the acquisition of proper tools and equipment if the results of the present experimental work warranted the continuation of this method of line sealing.

Any detailed information and data on this work would be too voluminous for such a report as this, therefore, no effort has been made to incorporate such facts herein and, in conclusion, the final appraisal of the worth of the method of sewer line sealing employed on the District sewerage system awaits the arrival of winter rains.

Yours very truly,

MARSHALL WALLACE
SANITATION ENGINEER

Report 5 (Page 1 of 5)

April 14, 1960

Board of Directors
Sonoma Valley County Sanitation District
County Administration Center
2555 Mendocino Avenue
Santa Rosa, California

Re: District sewer line sealing
during period from June, 1959
to April, 1960.

Gentlemen:

As you are well aware, the Sanitation Department is currently conducting sewer line sealing tests within the Sonoma Valley County Sanitation District in an attempt to develop a practical and economical method of repairing the leaking sewer lines within the District sewerage system.

As previously reported to this Board of Directors by my letter of September 23, 1959, some two thousand eight hundred and fifty feet (2,850 ft.) of combined street laterals and those portions of house service sewers lying within the road rights-of-way, were treated as of that date. As the rainy season was late in arriving this year, an additional footage was treated giving a total treated length of some three thousand two hundred and forty-two feet (3,242 ft.).

As noted in the aforementioned Report of December 23, 1959, the final assessment of the efficacy of the line sealing had to await the arrival of the winter rains. In this respect some provisions had to be made to differentiate between the infiltration of ground water into the shallow house service sewer lines lying in private property - which were not treated - and the deeper street laterals - which were treated. Such a differentiation in source of infiltrating water was obtained by the installation of several sounding wells adjacent to the various house service sewer lines tributary to the treated street laterals. These wells enable a determination of the water level surrounding the house service sewers to be made, and obviously, when the water table recedes below the shallow house service sewers, any surplus water observed in the street laterals must have originated through leaks in the deeper lines.

Fortunately, a few photographs had been taken, a year prior to these sealing experiments, of some of the manholes on the lines being treated. These photographs taken the previous year can be compared with photographs taken at the same places this year to give, after due consideration of the total amounts of rainfall at dates of picture taking, a good idea of the change in infiltrating ground water into the sewerage system. Both the "before" and "After" photographs were taken during periods of rainfall so that the shallow line infiltration would be comparable.

Six photographs, as aforesaid, accompany this letter and, by comparing last year's pictures and the total rainfall as per date of picture taking with this year's photographs and included rainfall dates, I believe that the decrease in sewage flow--in spite of a considerable increase in seasonal rainfall this year over last year--is readily apparent.

Additional observations and photographs, made several days after actual periods of rainfall show even further decrease in flows and indicate the leaking out of the water surrounding the shallow portions of the house service lines between the property line and houses. This aspect of the District sewerage system leakage has further been observed during numerous excavations of house service sewer lines which were constructed simultaneously with the mains and street laterals of the District collection system. The majority of the lines thus exposed exhibited the same poor construction as seen on the said mains and street laterals. Obviously, these poorly constructed and shallow house service sewers take in large quantities of ground water during and shortly following periods of appreciable rainfall, and the District flow charts reflect this very fact.

These same flow charts also show that the deeper mains and street laterals provide, in contradistinction to the shallow portions of the house service lines, large volumes of infiltrating ground waters for months after the rains cease.

The difference in point of entrance of ground waters into the sewerage system should be kept clearly in mind when reviewing sewer line sealing operations; such as is now being done in the District, for both types of leakage contribute to the overall infiltration problems. As previously mentioned, the shallow line leakage provides a large proportion of the peak flows encountered during and directly after a period of appreciable rainfall while the deeper line leakage provides the main portion of the leakage which persists for long periods of time following such rainy periods. The line sealing currently being carried out in the District is primarily for the correction of the deeper line leakage; however, as soon as weather and ground conditions permit, the District forces will start repairing these aforesaid originally constructed house service sewer lines. Such repair work will be done at District expense subsequent to obtaining authorization for such work from the property owners of the lands over which the sewers are constructed. Admittedly, this is a large undertaking, but the leakage from these lines can get only worse, so the sooner corrected the better.

As to the cost of sealing sewer lines by the method under consideration, a two man District force, aided by one man from the South Park County Sanitation District, did all the sealing work with simple hand tools, so no significance can attached to the man hours required for said sealing. As to materials, however, the cost of sealing the lines amounted to slightly less than fifty cents ($0.50) per foot of line sealed.

To expedite the District sealing work the Board of Directors of the Sonoma Valley Sewer Maintenance District have, at my request, authorized the employment of two additional men to augment the present two man force. I am also recommending that another two men be employed for the 1960-61 fiscal year, for even a six man force is not too significant in size when it is realized that something in excess of thirty-six (36) miles of mains and street laterals, plus an estimated ten (10) miles of house service sewer line must be sealed.

Also authorized was the purchase of certain equipment to be used for this line sealing work. This equipment includes a wagon drill, air compressor, pick-up truck and a used dump truck. All of this equipment, with the possible exception of the wagon drill, can be used for regular maintenance work of the collection system so it cannot be classified as "specialized" equipment.

In summary, it can be said that many new problems and aspects of this new method of line sealing have come to light during this past year, and undoubtedly many more problems will continue to arise as the work progresses at an accelerated rate. However, I believe that the results of the sealing work to date warrant the proposed expanded effort, especially in view of the magnitude and cost of rebuilding the entire sewerage system.

It is respectfully called to your attention that a report from your Board of Directors is requested by the State Water Pollution Control Board regarding the progress made in alleviating sewage overflows within this District sewerage system. This report is requested prior to May 1, 1960.

Yours very truly,

MARSHALL WALLACE
SANITATION ENGINEER

12-20-60

San Francisco Regional Water
Pollution Control Board
State Building, 1111 Jackson Street
Oakland 7, California

Sonoma Valley County Sanitation District
operations as affecting Splude Road by-pass
for period April 1960 to December, 1960

Gentlemen:

A review of the factors pertaining to the subject operations appears to be in order and this report covers such operations for the period following my last report on such matters to the Sonoma Valley County Sanitation District Board of Directors, dated April 14, 1960, a copy of which was sent to your Board.

In reference to the extent of District line sealing operations, a total of some 3,242 lineal feet of District sewer line had been sealed at the time of writing of the aforesaid report, dated April 14, 1960, and, for budgetary purposes, it was estimated that between three (3) and four (4) miles of sewer line could be treated during the 1961-61 fiscal year. The actual lengths of sewer lines sealed, or in the process of being sealed, during the first five months of the 1960-61 fiscal year included some 7,607 feet of street laterals; 2,545 feet of house service sewers located between the street laterals and property lines; and 1,480 feet of house service sewers located between the property lines and buildings served. The pipe in this latter category of sewer line has been hand excavated on private property and the leaking joints, fittings, etc., repaired in a satisfactory manner.

Thus, to date, some 2.2 miles of sewer line have been or are being sealed, so it appears entirely probable that a full four (4) miles of sewer line can be sealed during this fiscal year.

Conclusive results as to the efficacy of the current sealing work await the arrival of the winter rains. To date, some six and two tenths (6.2) inches of rain have been recorded in the District rain gauge located at El Verano. This quantity of rain has been sufficient to start the small creeks running within the area wherein are situated the sewer lines being treated. This creek action is a good indication that the ground is becoming saturated, and, in conjunction with this observation, it has been noted that the manhole "weep" pipes installed in all manholes along treated lines have been introducing water into the manholes from an average distance of some six (6) inches over the top of the upstream sewer lines. This indicates that the majority of the street laterals under treatment are now below the ground water level as found along the said sewer lines.

Preliminary observations of flow through manholes of treated lines are quite encouraging. One example of the reduction in flow is illustrated by a section of sewer line on Los Lomas Road to the south of Arroyo Road in Boyes Springs. This section of line, virtually dry during the summer months, has, previous to our sealing efforts, commenced flowing following the appearance of water in the creek traversing this line. The depth of flow, as shown by photographic records, approaches the one-half full mark in a six-inch pipe, and this flow would continue unabated until the advent of the dry summer weather. On December 1, 1960, after a rain totalling nearly two (2) inches which started the creeks in the area flowing, the Los Lomas Road line had a meter trickle of water in it, indicating a significant reduction in line infiltration.

Previous to the start of this winter's rains, on August 30, 1960, to be exact, a water test was made on a section of recently sealed sewer line on Los Lomas Road to the north of Arroyo Road. This section of line selected to be tested had previously been tested on October 10, 1957, in the presence of the Sanitation District Board of Directors to determine the extent of street lateral leakage.

Originally, this test was made by exposing several joints in the sewer line; plugging the downstream manhole; filling the line with water from an upstream manhole; and observing the leakage from the exposed pipe joints. There should be a series of photographs in your files which accompanied by "Report No. 2 on the Sonoma Valley County Sanitation District", dated December 20, 1957. Photographs numbered 3, 4 and 5 of this group show this said line under test, and it is this same line on which the aforesaid test of August 39, 1960, was conducted.

At the time of the original test of October 10, 1957, this sewer line under test could not be filled from a water tank truck capable of emptying approximately two-hundred (200) gallons per minute of water into the line. After sealing this same line the leakage rate was less than one (1) gallon per minute, as shown by the August 30, 1960 test - a rather significant reduction in sewer line leakage by any standards.

As the rainy season progresses, photographic records of flows will be made in both treated and untreated portions of the sewerage system. In this way the District can evaluate the results of both current and future corrective work.

A record of another nature is now available to the District and your Water Pollution Control Board, this record being the period of overflow of the Splude Road by-pass. The District has installed a recording meter at the overflow structure which gives a permanent record of the periods of time of any overflows occuring at this location.

As to the future plans of the District regarding sewerage system corrective work and District sewer service policy, I recently submitted to the Board of Directors of the Sonoma Valley County Sanitation District and the Sonoma Valley Sewer Maintenance District a letter of transmittal, Report and "Recommended Requirements Precedent to Annexation to the Sonoma Valley County Sanitation District", all dated December 5, 1960, which set forth my recommendation on the subject. Copies of these items are included herewith for your perusal.

As submitted to the aforesaid District Board of Directors, I recommended that a five-year program be promulgated to seal and repair a minimum of seven (7) miles of sewer line per year to correct the estimated thirty-six (36) miles of line requiring such treatment.

To facilitate such work, which will cost an estimated $63,000.00 per year, I have recommended that certain annexations be allowed to the District and a $250.00 connection fee per individual connection (or "Equivalent connection" as defined in existing District Resolutions) be assessed against the property and deposited in a special District sewerage system and treatment plant repair and improvement fund to be used "solely for the purpose of repair and improvement of the sewage collection system and treatment plant".

These recommendations, are as mentioned above, included with this Report for your review.

I also recommended to the District Boards the connection of the Archbishop Hanna Center for Boys to the District sewerage system, a condition to such a connection being the agreement of the Hanna Center to prohibit any sewer connections to a certain portion of their lands presently lying within the boundary of the Sanitation District.

As to definite action taken by the said District Boards to implement my recommendation on the above matters, said Sanitation District Board did by Resolution dated December 12, 1960, authorize and direct - "The County Counsel to Prepare a District Resolution Establishing Requirements for Annexation to the Sonoma Valley County Sanitation District, said requirements to be in conformance with Those

Recommended by the County Sanitation Engineer." Also, by District Resolution, dated December 12, 1960, the Sanitation District Board authorized and directed - "The County Counsel to Prepare an Agreement Between the District and the Archbishop Hanna Center for Boys to Provide for Treatment and Disposal of Sewage from the Archbishop Hanna Center for Boys in Accordance with the Recommendations of the Sonoma County Sanitation Engineer."

Thus, I think it is clear that the Boards of Directors of the Sonoma Valley County Sanitation District and the Sonoma Valley Sewer Maintenance District fully appreciate the problems underlying the necessity of maintaining the Splude Road overflow structure and are taking all feasible steps to eliminate the use of said overflow structure.

Yours very truly,

MARSHALL M. WALLACE
SANITATION ENGINEER

May 19, 1961

San Francisco Regional Water Pollution Control
Board
State Bldg., 1111 Jackson Street
Oakland 7, California

Sonoma Valley County Sanitation District
operations as affecting Splude Road by-pass
for period December 1960 to June 1961

Gentlemen:

As per the request of your Board at its regular meeting on March 16, 1961, a report relevant to the progress being made by the Sonoma Valley County Sanitation District towards the elimination of the overflows at the Splude Road overflow structure is herein submitted.

Mention was made in my previous Report to your Board, dated December 20, 1960, of the installation of a recording meter at the Splude Road overflow structure to permanently record the time and duration of overflows through that structure. A summary of such overflows is shown in Table I, herein.

TABLE I

1960-61 SPLUDE ROAD OVERFLOWS

DATE OF OVERFLOW	DURATION OF OVERFLOW (HRS.)
December 1, 1960	3.8
January 26, 1961	7.5
January 29, 1961	8.2
January 31, 1961	21.0
February 1, 1961	2.2
February 2, 1961	10.8
February 9, 1961	9.0
February 11, 1961	8.8
March 14, 1961	3.0
March 26, 1961	3.5
TOTAL HOURS OVERFLOW	77.8

Thus it can be seen from Table I that overflows occurred on ten days of the 1960-61 rainy season for a total yearly overflow time of 77.8 hours.

Again referring to my previous report dated December 20, 1960, it was estimated that District forces would seal approximately four (4) miles of sewer line during the current 1960-61 year. This estimate still appears reasonable, for to date—with one and one-half months remaining in this fiscal year--the actual lengths of sewer line sealed or in the process of being sealed amounts to approximately 3.6 miles and includes some 12,466 feet of street laterals; 4,163 feet of house service sewers located between the street laterals and property lines; and 2,293 feet of house service sewers located between the property lines and buildings served. As noted in previous reports, the sewer pipe in the latter category of sewer line is hand excavated on private property for subsequent repair work. Some one hundred (100) such services have been thus repaired during the current fiscal year.

Observations and photographic records of treated lines indicate good results are being obtained by the present District sealing process, and, as you were previously informed by Sanitation District Resolution No. SA 21893, dated February 20, 1961, the District intends to seal or repair a minimum of five (5) miles of sewer line during the 1961-62 fiscal year.

Further, the District has been negotiating with the City of Sonoma to amend the present City of Sonoma - District Agreement to facilitate the proper control of both excessive flows and excessive sewage loadings on the District facilities. A copy of the District Resolution No. SA 22616 implementing such negotiation, entitled "Resolution of the Board of Directors of the Sonoma Valley County Sanitation District Directing the County Counsel Contact City of Sonoma re Negotiation of Revision to Sonoma Valley County Sanitation District Contract with the City of Sonoma", is enclosed herewith for your files.

Also enclosed is a copy of the letter of transmittal from Mr. Crandall, Director of Public Works, City of Sonoma, accompanying his report - a copy of which is enclosed herewith - on the action taken by the City of Sonoma to reduce the wet weather flows contributed by said City to the District sewerage system.

If further information pertinent to this subject is required, please contact me.

Yours very truly,

MARSHALL M. WALLACE
SANITATION ENGINEER

San Francisco Regional Water
Pollution Control Board
State Building, 1111 Jackson Street
Oakland 7, California

Sonoma Valley County Sanitation District operations as affecting Splude Road by-pass for period June, 1961 to October 30, 1961

Gentlemen:

A report on the progress of the subject District operations is hereby submitted for your consideration.

As your Board was previously informed, the Sonoma Valley County Sanitation District Board of Directors stated their intention of sealing or repairing a minimum of five (5) miles of sewer line during the 1961-62 fiscal year.

Since their declaration of intention, as set forth in Sanitation District Resolution No. SA 21893, dated February 20, 1961, the District Board of Directors has provided in the 1961-62 Budget sufficient funds to seal or repair the stated length of line. Further, the District has employed an additional workman to assist in the line sealing and repair work.

As of October 15, 1961, 1.5 miles of District sewer line has been sealed or repaired, or is in the process of being sealed or repaired, since the last District report to your Board, dated May 19, 1961.

This length of line includes some 5,997 feet of street laterals; 1,265 feet of house service sewers located between the street laterals and property lines; and 473 feet of house service sewers located between the property lines and buildings served. As noted in previous reports, the sewer pipe in the latter category of sewer line is hand excavated on private property for subsequent repair work.

Included in the total length of sealed or repaired street lateral sewer lines are some 534 feet of sewer line creek crossings. This length represents four crossings of airly large wet weather creeks in an area of the District not presently being worked on insofar as line sealing is concerned. These crossings were in poor condition and undoubtedly have contributed substantial quantities of extraneous water to the District's sewerage system during the period of the year when such water courses were flowing. Also, the complete reconstruction of these crossings, often done under the added handicap of working under low bridges, consumed an inordinate amount of the District Force's working time for the apparently short lengths of sewer line involved. However, the results of this work should be most beneficial to the District.

Pertinent to your Board's request for data relevant to the dry weather sewage flows from the Sanitation District, City of Sonoma, and Sonoma State Hospital, the attached chart gives the daily sewage flows from these entities for the months of May to September, inclusive, for the years 1959-61, inclusive.

A summation of the dry weather flows for the period 1959-61, inclusive, is given in TABLE I, herein. Of interest to the District is the sharp increase in dry weather flow from 1960-61. During this period slightly fewer new District sewer connections were made than during the previous year, namely, 1959-60. Part of this increase in flow is due to additional swimming pool discharges into the District facilities during the summer months, but other factors must account for the greater portion of this increased flow. We do not feel that the factors accounting for the increased dry weather flow are sufficiently well defined at this time to draw any conclusions therefrom.

TABLE I

AVERAGE DRY WEATHER SEWAGE FLOWS

(In Million Gallons)

For Months of May - Sept., Incl.

For Period 1959-61, Inc.

	YEAR		
	1959	1960	1961
City of Sonoma	0.276	0.244	0.344
Sonoma State Hospital	0.354	0.398	0.341
Sonoma Valley County San. District	0.262	0.275	0.459

The data concerning the "date and time" of each by-pass period at the Splude Road by-pass structure, which has been requested by your Board, appears in TABLE II, herein. This table is repeated from the District report to your Board, dated May 18, 1961. No overflows have occurred subsequent to those shown in TABLE II.

TABLE II

1960-61 SPLUDE ROAD OVERFLOWS

DATE OF OVERFLOW	DURATION OF OVERFLOW (HRS.)
Dec. 1, 1960	3.8
Jan. 26, 1961	7.5
Jan. 29, 1961	8.2
Jan. 31, 1961	21.0
Feb. 1, 1961	2.2
Feb. 2, 1961	10.8
Feb. 9, 1961	9.0
Feb. 11, 1961	8.8
Mar. 14, 1961	3.0
Mar. 26, 1961	3.5
TOTAL HOURS OVERFLOW =	77.8

As to the hourly rate of flow from each entity during periods of overflow from the Splude Road by-pass structure, the following is pertinent:

The State Hospital and City of Sonoma flows are separately metered, and the District flow is calculated as being the difference between the sum of those two flows and the total metered flow to the sewage treatment plant. Thus, during periods of overflow at the Splude Road by-pass structure, the total metered flow at the sewage treatment plant is limited to approximately 6 M.G.D. - the maximum pumping capacity of the treatment plant - so the hourly District flow is unknown. Also, during such periods of overflow, the City of Sonoma meter often "pegs out" at 2.7 M.G.D. and again an hourly flow reading from this source is meaningless.

As previously mentioned in relation to the problem of metering during periods of overflow, the maximum pumping capacity of the sewage treatment plant is slightly less than 6 M.G.D. When the total flow to the treatment plant exceeds this figure there will be resulting overflows at the Splude Road by-pass structure.

If further information pertinent to this subject is required, please contact us.

Yours very truly,

MARSHALL WALLACE
SANITATION ENGINEER

PROGRESS REPORT
LINE SEALING AND REPAIR
SONOMA VALLEY SANITATION DISTRICT
3-1-60 to 3-1-62

The progress made in sewer line sealing and the repair of defective sewer lines and appurtenances for the subject period along with other pertinent information regarding such work is given to acquaint your Board of Directors with the present status of this undertaking.

Part I - General Review

A review of the files in the Sanitation Department reveals that work on the external sealing of sewer lines in this District was started prior to March 7, 1960. It was on this date, however, that the Board of Directors passed Resolutions No. Sa19224, SA19225 and SA19226. This marked the beginning of an integrated program of sealing and repairing of defective sewer lines and appurtenances. All work prior to this date can be considered experimental. A letter addressed to your Board, dated April 14, 1960, gives the total footage of line sealed or repaired as some three thousand two hundred and torty-two feet (3,242 feet). I have considered this amount to be the extent of the experimental development of the process. The above mentioned letter also estimates the total amount of work remaining to be in excess of thirty-six (36) miles of mains and street laterals, plus an estimated ten (10) miles of house service sewer line. The records in the Sanitation Department set up the accounts entitled "Line Sealing and Repairing Material - C.S. 50" and "Line Sealing Equipment and Tools - C.S. 510" as of March 1, 1960. Therefore, for the purpose of this report, I have taken March 1, 1960 as the effective date of the beginning of an integrated program of line sealing and repair of sewer lines in this District.

The progress of this integrated program is contained in various reports to this Board and to the San Francisco Regional Water Pollution Control Board. The following are exerpts from these reports:

December 20, 1960

"The actual lengths of sewer lines sealed, or in the process of being sealed, during the first five months of the 1960-61 fiscal year included some 7,607 feet of street laterals; 2,545 feet of house service sewers located between the street laterals and property lines; and 1,480 feet of house service sewers located between the property lines and buildings served."

"Thus to date, some 2.2 miles of sewer lines have been or are being sealed . . ."

February 20, 1961

On this date the Board of Directors passed Resolution No. SA21893 setting of a schedule to "seal or otherwise repair approximately five (5) miles of District sewer annually until the collection system deficiencies are corrected."

May 19, 1961

"The Actual lengths of sewer line sealed or in the process of being sealed amounts to approximately 3.6 miles and includes some 12,466 feet of street laterals; 4,163 feet of house service sewers located between the street laterals and property lines; and 2,293 feet of house service sewers located between the property lines and buildings served."

The first two months of this fiscal year saw little actual line sealing work accomplished as some 694 lineal feet of main line creek crossings, representing nine (9)* such crossings were excavated and completely rebuilt or replaced. This work had to be done when climatic conditions were favorable.

This creek crossing work was difficult and slow at best but was undoubtedly very beneficial in reducing District sewer line infiltration. Photographic records on file in the Sanitation Department show nearly complete joint failure on all crossings repaired. There is no practical way to measure such infiltration on the creek crossings so repaired, however, in the area where the sewer lines are presently being sealed and repaired a newly installed recording meter--one of two (2) installed this winter--made possible the measurement of infiltration through a similar unrepaired creek crossing. This line is less than three hundred and fifty (350) feet long and it had a leakage rate in excess of 68,500 gallons per day (g.p.d.) under conditions of extremely low stream flow during the early part of this month. (March - 1962)

Thus, it appears that the 694 lineal feet of repaired creek crossings were well worth the time and effort spent, for the quality of the sewer pipe joints and creek crossings construction appears uniformly poor throughout the collection system.

In addition to the creek crossing repairs, some 914 lineal feet of house service sewers situated on private property between the house, or other buildings and the property line were hand excavated, repaired, backfilled, and the yards and lawns (where present) were replaced to their former conditions. Again, this is slow laborious work but as pointed out in previous reports of this nature, until these faulty house service sewer lines are repaired - and there are an estimated 10 miles of such line - the infiltration from such sources can only increase as the joints are further deteriorated under the impetus of roots and water action into and out of the joints.

*List attached.

The extent of sealing of main line sewers and house service sewers situated within the roads of sewer easements is 4,647 lineal feet of main sewers and 1,154 lineal feet of house service sewers. The total line sealed or repaired during this fiscal year up to March 1, 1962, is some 1.40 miles, considerably less than the goal of five miles. However, with the advent of better weather and with the sealing crew concentrating on line sealing rather than the slower creek crossing excavations, as done earlier in the year, it is still possible to have the desired footage under treatment by the end of this fiscal year. The importance of these creek crossings repairs should not be underestimated, however, as their repair results in infiltration corrections far outweighing relative lengths of ordinary street sewer sealing. During the early part of the 1962-63 season other creek crossings, such as the one previously mentioned in this report, having an infiltration rate in excess of 68,500 g.p.d., will be repaired - again at the cost of sealed line footage.

The question of the effectiveness of the District line sealing and repair program is often raised and this question is constantly under review by myself and other District and County personnel. A few aspects of this problem will be reviewed to point out what is being done to determine the effectiveness of the process.

The less controversial portions of the sealing program are more or less self-evident as to their efficacy. These portions of the work are (1) the excavation and repair of the house services situated on private property, and (2) the reconstruction of creek crossings. Descriptions and photographs of the conditions of such sewer lines clearly show the results obtained, but, except in rare instances the progress made in reducing the line infiltration cannot be reduced to a definite number of gallons per day flow.

As to the efficacy of the lines sealed by the method developed by the Sanitation Department, that of impregnating the ground and breaks or other defects in the sewer pipe, joints, manholes and related appurtenances with asphaltic materials from outside the pipes and appurtenances, this is the main point of contention. Past records show that many exhaustive tests and excavations were made during the development of this sealing process, and many progress reports on this development were submitted to your Board. Literally hundreds of photographs of this work were taken and are on file in the office of the Sanitation Department. These photographs and photos of wet weather and dry weather flows through the majority of the District's manholes are on file and have been shown to various interested parties including members of this Board of Directors, members of the Sonoma Valley Chamber of Commerce Sanitation Study Committee, and representatives of the State and local health departments. As mentioned previously, two recording meters have recently been installed in the areas presently having sewer lines sealed or about to be sealed. One of these meters is in an area where the sewer lines are presently unsealed but where it is anticipated that said lines will be sealed in the near future. In this way the present flows - up to the point of complete surcharge of the lines - can be compared to the flows subsequent to sealing. This meter is located in Manhole T-71, and is indicated on drawing 1087B-2 (enclosed). All of the lines tributary to this manhole will be treated or repaired by July 1, 1963. I believe that this meter will clearly show the effectiveness of the integrated operation of sealing and repairing. Exact flow figures before and after sealing can then be easily compared.

The other meter presently meters an area composed of approximately five-sixths treated lines and one-sixth untreated lines. The only thing that can be shown here by photographs of the two lines is that the untreated one-sixth of the area is contributing approximately the same wet weather flow as is coming from the treated area which has approximately five times the collection system as the untreated area. This entire area is also scheduled to be sealed and repaired by July, 1963.

Drawings No. 1087B-1 and No. 1-87B-2 (enclosed) show the District areas where line sealing and repair work is presently being done and where work for the next year is contemplated.

Of the particular interest in this matter of infiltration is the change in the District dry weather flow last year as compared to the previous two years dry weather flow. These data were given to the State Regional Water Pollution Control Board in the District's semi-annual report, dated October 30, 1961. These flows were averaged over the five dry months of May to September, inclusively, for the years 1959-1961, inclusively. During the 1960-1961 fiscal year some 3.6 miles of sewer line were sealed or repaired. In 1959 the average District dry weather flow during this period was 0.262 M.G.D., during the 1960 year the flow for this period was 0.275 M.G.D., and for the 1961 year, the period following the initial year of line sealing and repairing, the flow was 0.459 M.G.D. During this latter year slightly fewer new District sewer connections were made than during the previous (1959-60) year. No conclusions were drawn as to this cause of the increase dry weather flow but photographic evidence of dry weather sewage flows for various years in treated areas show a definite increase in such flows although the number of new connections are negligible. It appears that sewage formerly leaking out of defective sewer lines in the collection system during dry weather is now staying inside the pipe and reaching the sewage treatment plant.

In conclusion of Part I, as of March 1, 1962, there are approximately 5.0 miles of lines either sealed or repaired, consisting of 17,113 lineal feet of street laterals; 5,317 lineal feet of house service sewers located between the street laterals and property lines; and 3,801 lineal feet of house service sewers and creek crossings. This footage does not include sealing work in progress.

Part II - Cost Data

The cost data contained herein was derived from the various sources as noted. The components of the cost of line sealing and repairing consist of Salaries, Material and Equipment (Capital Outlay).

As explained in Part I, I have assumed that the starting date of this work as March 1, 1960. All work prior to this date was considered experimental and the costs are not included herein.

TABLE I

	Salaries	Material	Equipment Capital Outlay
March-June 1960	*Employees (1) $7,001.79	(2) $2,012.91	(2) $12,440.94
1960-1961	*Employees (2) 29,572.92	(2) 12,752.86	(2) 3,200.91
1961-2/28/62	*Employees (3) 23,608.83	(3) 10,260.28	(3) 1,006.42
TOTAL	$60,183.54	25,026.05	16,648.27

Total Expenditures $60,183.54
25,026.05
16,648.27
$101,857.86

(1) Cost Records in the Sanitation Department (a copy is enclosed)

(2) Page 167, "Final Budget 1961-62 and Statistical Report 1960-61"

(3) Cost Records in the Sanitation Department (a copy is enclosed)

*The Salaries include that of all personnel assigned to the collection system whether or not they are engaged in the line sealing and repairing system.

The present personnel consist of:

1 - Sewer Maint. Supervisor
2 - Sewer Maint. Foreman
3 - Sewer Maint. Man
4 - Sewer Maint. Helper

I have checked the personnel records but it is very difficult to separate the time spent on routine maintenance from that spent on line sealing and repairing. In discussion with the Sewer Maintenance Supervisor, Mr. Robert Bell, he says that conservatively about 75% of his time and all that of one of the Sewer Maint. Man is spent on either routine maintenance or enforcement of the requirements of Ordinance 320. The material is shown in detail on the Sanitation Department work sheets, entitled C.S. 50. Copies of these work sheets are included herein for the periods shown in Table I.

Equipment, or "Capital Outlay" is also shown in detail on the Sanitation Department work sheets, they are entitled C.S. 510. Copies of these work sheets are included herein for the periods shown in Table I. The bulk of this item is for equipment and tools which can also be used in routine maintenance work. This necessary equipment and tools are now complete and nothing has been requested in the budget for the fiscal year 1962-1963.

Due to the uncertainty of the applicable portions of the salary figures and the assumptions that have to be made in order to apply a write-off figure for the equipment, a truly accurate cost accounting of the line sealing and repairing costs is difficult to obtain.

A conservative approach for the total cost of the integrated line sealing and repairing is presented merely as a guide. My assumptions are noted, and they represent to the best of my knowledge the fairest, approximation to the actual costs.

A. Salaries

Position	3/1/60-7/1/60	60-61	7/1/61-3/1/62	*Routine Maint.	*Line Sealing & Repairing
S.M. Sup.	1754.09	6127.45	4312.00	9145.15	3048.39
" Foreman	1475.13	4660.08	3280.00	—	9415.21
" Man	1568.00	8771.13	5933.32	8920.17	7352.28
" Helper	2204.57	10014.26	10083.51	—	22302.34
Sub-total	7001.79	29572.92	23608.83	18065.32	42118.22
		60,183.54		60,183.54	

*One Sewer Maintenance Man spends 100% of his time on routine maintenance.

*The Sewer Maintenance Superintendent spends 75% of his time on maintenance and 25% on line sealing and repairing.

B. Line Sealing and Repairing Materials (C.S. 50)

From Table I $25,026.05

C. Line Sealing Equipment and Tools (C.S. 510)

Board of Directors Resolution No. S.A. 21893 sets up a schedule of five miles per year until the deficiencies are corrected. The total present system comprises approximately 35 miles of mains and approximately 10 miles of house services, therefore a total of 45 miles of line to be repaired. However, it has been assumed that by 1968 when 38.6 miles are scheduled to be complete that the corrections thus made will have reduced the infiltration to such an extent as to eliminate the necessity of the Splude Road Bypass. If this is the case, then the necessity of expending further funds for sealing or repairing is probably not justified. For the purpose of this report, I have accepted these assumptions.

Total expenditure for Equipment (Table I) $16,648.27

Assuming that the equipment will be used from July, 1960 to July, 1968 and that it will have a salvage value of 50% of the initial purchase price, then the cost per year may be computed on a straight line basis.

$$\frac{16,648.27}{2 \times 8} = \$1,040.52/\text{year}.$$

D. Unit Costs for Line Sealing and Repairing

The project has been under way since March 1, 1960 and the period of this report ends March 1, 1962. Therefore, a full two years of operations are reflected.

Salaries	42,118.22
Materials	25,026.05
Equipment 2 x 1,042.52	2,085.04
Total Cost	69,129.31

Total mileage complete (3/1/62) = 5.0 miles

$$\text{Unit Cost} = \frac{69,129.31}{5} = 13,825.86$$

I consider this figure to be conservative due to the following factors:

1. Several expensive and time consuming creek crossings were repaired during this period.
2. Practically all the personnel were hired and trained during this period, therefore, I would assume that their efficiency will increase as the program progresses.
3. Several difficulties have been ironed out during this period. Quoting from M. M. Wallace in a letter dated March 14, 1961, "No blueprints went with this sealing method as we developed it from scratch in an attempt to provide an economical and lasting correction to the District's deteriorating sewage system".
4. The total mileage does not reflect work in progress.
5. The total cost does not reflect the time spent by the entire crew in maintenance.

E. Estimated Total Overall Cost (figures rounded to the nearest $1000)

35 miles @ $14,000/mile = $490,000

Funds expended 3/1/62 = 69,000

Total estimated cost to complete = $421,000

F. Alternate Methods

It doesn't seem of too much value to review the many previous reports to this Board as to the progress made in developing the sealing process presently used in the District or to review the reasons why other processes were not recommended. However, one such alternate is that of replacing the entire existing District sewer lines and the original house service sewers. This solution, I am sure, would be satisfactory to the State Regional Water Pollution Control Board. This method would eliminate the very real inconvenience of the barrels pipes and spilled asphalt from broken pipes. In a letter to your Board dated October 6, 1960, Mr. M. M. Wallace estimated the cost of complete replacement at approximately $2,500,000. I have analyzed this cost and consider it to be conservative, my reasons are as follows:

(1) District lines are presently transporting some 459,000 gallons per day of sewage during the dry months of the year (Page 7, this report);

(2) Lines are up to sixteen (16) feet in depth and are generally backfilled with rocks resting directly upon the pipe (refer to Sanitation Dept. photographic records);

(3) Pipes are resting on rocks making necessary additional trenching below the existing trench bottom and importing bedding material to provide adequate support for the new pipe;

(4) Backfill requirements in County Roads, wherein lies the majority of the pipe, would be rigid to prevent road surface subsidence;

(5) House service sewers on private property would necessarily have to be hand dug - as is presently being done - and, together with any lawns, shrubs, etc., replaced.

(6) Existing lines into manholes would have to be broken out of the manholes and new lines - in most cases new manhole inverts - installed.

(7) The 138 required-but non-existent-manholes should logically be installed at this time.

(8) The total cost of the original system was approximately 2 million dollars, deducting the cost of the treatment plant, about $500,000, this leaves a net original cost of approximately 1.5 million dollars. Considering the increases in construction costs, the obvious need for more rigid specifications, and the necessary of now working with a live sewer, I conclude that the $2.5 million dollar estimate is conservative. The estimate difference in cost between the present system of line sealing and complete replacement is the difference between $500,000 and $2.5 million dollars.

Part III - Engineering Costs

Year	Line Sealing ($)	Investigation ($)
59-60	1706.97	751.93
60-61	1694.87	674.96
61-3/1/62	508.99	-0-
Total Above	$3,910.83	$1,426.89

Part IV - Conclusions

This report, to the best of my knowledge and ability, reflects the progress and costs, past and present and future of the line sealing and repairing program in the Sonoma Valley Sanitation District.

From the information and data contained herein, I conclude -

1. That the present line sealing and repairing program is proceeding on schedule.

2. That the cost of the program for the first two years appears reasonable. I believe, for the reasons stated herein, that this unit price will decrease.

3. That by July, 1963, the two areas now metered and under treatment will be completely sealed and repaired. The flow records from these meters will provide accurate figures as to the effectiveness of this program.

4. That the very real inconvenience of the line sealing and repairing program should be weighed against--

    a. The inconvenience of the residents at the lower elevations within the District who are subjected to surcharged and overflowing sewers on or adjacent to their property, and

    b. The difference between $500,000 and $2.5 million dollars for complete replacement.

DONALD B. HEAD
SANITATION ENGINEER

Line D	Oak St., West of MH 38	25'
Line E-3	Btwn. Laurel & Grove, East of MH 48	30.5'
Line E-5	Hickory St., North of MH 48	30'
Line E-2	North of Verano Ave., West of MH 53	450'
Line E-7	Btwn. Verano & Laurel, West of M.H. 49	28.5'
Line A	Petaluma Ave., west of MH 60	32'
Line C	Walnut Ave., west of MH 46	30'
Line E-2	Bay St., north of MH 46	30'
	Alley in LID I, south of Hawthorne Ave.	38'
	Total	694.0'

San Francisco Regional
Water Pollution Control Board
State Building, 1111 Jackson Street
Oakland 7, California

Gentlemen:

Sonoma Valley County Sanitation District
operations as affecting Splude Road bypass
for period October 30, 1961 to June 1, 1962

Submitted herewith a report, entitled "Progress Report - Line Sealing and Repairing - Sonoma Valley Sanitation District - March 1, 1960 to March 1, 1962," which, I believe adequately covers the subject District operations to March 1, 1962.

District operations between March 1, 1962 and June 1, 1962, have increased the total lengths of line sealed or being sealed to the following lengths:

1.	Street laterals	8722 L.F.
2.	House service sewers within street or R/W	2391 L.F.
3.	House service sewers on private property	859 L.F.
4.	Creek crossings	694 L.F.

Of possible interest to your Board are the two maps attached to the aforesaid "Progress Report" showing both the location of sewer lines which have been sealed or are in the process of being sealed, and the location of sewer lines to be sealed during the 1962-63 fiscal year.

If further information relative to District operations affecting the Splude Road by-pass is required, please contact this office.

Yours very truly,

DONALD B. HEAD
SANITATION ENGINEER

Report 11-1 (1 of 4)

January 29, 1965

San Francisco Regional
Water Pollution Control Board
State Building, 1111 Jackson Street
Oakland 7, California

Sonoma Valley County Sanitation District operations as affecting Splude Road by-pass as of this date

Gentlemen:

A report on the progress of the program to eliminate the Splude Road by-pass and treatment plant expansion, as requested at the recent meeting attended by your Mr. James and Mr. Dierker, Supervisor Vella, and Mr. Head of this office, is hereby submitted for your consideration.

The elimination of the Splude Road by-pass is conditioned upon four major factors which are either presently under way or planned for the near future. These four factors consist of the sealing program, expansion of the treatment plant, construction of settling structures and pressurization of the outfall.

As noted in previous communications, the Sonoma Valley County District Board of Directors established funds to seal and repair sewer lines as of July 1, 1961. As of February 1, 1965, some 14 miles of District sewer line have been sealed or repaired. This length of line includes 47,190 feet of street laterals, 10,902 feet of house service sewers located between the street laterals and property lines; 1600 feet of creek crossings completely rebuilt and encased in concrete; and 15,050 feet of house service sewers located between the property lines and buildings served. The 15,050 feet of house service sewers which were either repaired or replaced represents some 341 house services. During the summer of 1964 it was necessary to replace the siphon under the Sonoma Creek at Madrone Road. Approximately 500 man-hours were required for this job. Of necessity, the house service repairs were reduced during this time.

During the past six weeks an additional method of decreasing sewage flow has been initiated. On each property line cleanout is placed a cast iron body cleanout with a recessed head brass screw plug. A concrete traffic type box is next placed over the cleanout. On the old type cleanout with the asbestos cement cap, or vitrified clay plug, it was very easy for the property owner to knock a hole in the cap to drain the flood water from his property. Three such broken caps were found in replacing approximately 150 cleanouts. This seems like a small number, but each one was capable of dumping 50 to 75 thousand gallons of water per day into the sewer system. We feel that with the brass caps and traffic boxes the amount of storm flow into cleanouts will be reduced to a minimum.

In order to maintain one crew on house services at all times, an additional man is being requested in the 1965-66 fiscal year budget. Although the length of sewer line sealed is a little behind the estimate proposed by the Board of Directors, the work on the creek crossings and easements, while very time consuming, has proven beneficial in the total program. We feel that, with the additional man, the time schedule established for the sealing program will be met.

The three factors other than the sealing program are considered as one package. The master plan for the expansion of the treatment plant, as proposed by Engineering-Science, recommends that the plant be converted to an activated sludge type plant with a capacity of four million gallons a day dry weather flow. The hydraulic capacity, including pumping facilities for the outfall, would be approximately thirteen million gallons a day.

In addition to the expansion of the hydraulic capacity, a primary settling unit with a seven and one-half million gallons per day capacity will be constructed to receive excess flow. These structures would be utilized in the next plant expansion. The pressurization of the outfall is to be included in the plant expansion.

The following actions have been taken by the Sonoma Valley County Sanitation District:

1. The District has requested Public Law 560 funds in the amount of $49,900.00 in accordance with the Program of Advances for Public Works Planning. Plans for the expansion of the Sonoma Valley Treatment Plant will be started within 5 days after receipt of these funds, and completed plans will be available within 130 calendar days.

The intent of the Sanitation District is to have an election for a bond issue prior to July 1, 1965. A meeting was held at the Sonoma Veterans Memorial Building on January 11, 1965, for the purpose of presenting to the people of the Valley the proposed expansion of the District sewage facilities. The consensus of the people present was that the bond issue should include funds for the expansion of the plans and the construction of the westerly trunk. Since a school bond issue and recall election were scheduled for January 19, 1965, it seemed best not to cloud the issue with talk of the sewer bonds.

If the District is granted funds from the Housing and Home Finance Agency for the preparation of plans and specifications for the expansion of the treatment plant, the project will be advertised for bids soon after approval of the bond issue.

Based on the above mentioned time schedule, the new sewerage facilities should be in operation approximately November 1, 1966.

2. The District is presently negotiating with the City of Sonoma on a new agreement for treatment charges. Completion of this agreement is vital to the District as it will be difficult to receive approval of a bond issue without a satisfactory agreement with the City of Sonoma. A proposed agreement has been submitted to the City for consideration.

The information contained herein is contingent upon approval from the Federal Government and the residents of the Sonoma Valley County Sanitation District. The sealing program will continue, and it is believed that the latter phase of plant expansion and sewer trunk line construction will alleviate the by-pass problems and also produce an effluent to meet the requirements of the Water Pollution Control Board.

If further information is necessary, please so inform this Board.

Very truly yours,

Leigh Shoemaker
Ignazio Vella
Talbert Bean

Report 12-1 (1 of 2)

July 28, 1965

Regional Water Pollution Control Board
State Building, 1111 Jackson Street
Oakland, California

Sonoma Valley County Sanitation District operation as affecting Splude Road bypass for period January 29, 1965 to July 23, 1965

Gentlemen:

A report on the progress of the program to eliminate the Splude Road bypass and treatment plant expansion as required by Resolution 649 is hereby submitted for your consideration.

District operations from January 29, 1965 to July 23, 1965, have produced the following corrections in the Sonoma Valley County Sanitation District sewerage system;

1. Street lateral sewers having a total length of some 3278 lineal feet have been sealed or are in the process of being sealed.
2. House Service sewers on private property having a total length of some 3433 lineal feet have been removed and replaced with new pipe. This length of pipe represents 61 house service sewers on private property.
3. House service sewers lying within streets or easements having a total length of 587 lineal feet have been sealed or are in the process of being sealed.

The District, as stated in previous correspondence, has applied for Public Law 560 funds which are to be used to prepare plans and specifications for the expansion of the Sonoma Valley Treatment Plant. These funds have been approved and a contract was executed on June 23, 1965, between Engineering-Science, Incorporated and the District for the preparation of said plans for the plans. The facilities to be designed by the Engineering-Science Staff will enable the District to completely eliminate the necessity of the Splude Road bypass. The above mentioned plans and specifications are to be completed within 130 calendar days from the date of the executed contract.

The District is presently awaiting the final word from the City of Sonoma regarding the crushing of grapes and the distilling process activities from the Sebastiani Winery. Mr. Sebastiani indicated that he would relocate his grape crushing and distilling process rather than pay the necessary costs to expand the treatment plant. When the final decision as to the dispensation of the wine wastes is submitted in writing, the final design of the treatment plant can be completed.

If further information is desired, please feel free to contact this office.

Very truly yours,

DONALD B. HEAD
SANITATION ENGINEER

SPLUDE ROAD OVERFLOWS

Dec. 1, 1960 - March 26, 1961

Date of Overflow	Overflow (Hrs.)
12-1-60	3.8
1-26-61	7.5
1-29-61	8.2
1-31-61	21.0
2-1-61	2.2
2-2-61	10.8
2-9-61	9.0
2-11-61	8.8
3-14-61	3.0
3-26-61	3.5

SPLUDE ROAD OVERFLOWS

Aug. 21, 1961 - May 15, 1962

Date of Overflow	Overflow (Hrs.)
12-1-61	15.3
12-2-61	5.3
1-14-62	9.8
2-9-62	10.7
2-13-62	24.0
2-14-62	24.0
2-15-62	24.0
2-16-62	24.0
2-17-62	13.0
2-18-62	24.0
2-19-62	14.8
2-20-62	6.3
3-2-62	8.8
3-5-62	11.0
3-6-62	24.0
3-7-62	16.5
3-8-62	6.0

SPLUDE ROAD OVERFLOWS

Oct. 5, 1962 - May 13, 1963

Date of Overflow	Overflow (Hrs.)
12-15-62	7.0
12-17-62	15.0
12-18-62	10.0
1-30-63	17.0
1-31-63	24.0
2-1-63	23.8
2-2-63	24.0
2-3-63	3.3
2-9-63	5.0
2-10-63	2.0
2-12-63	5.0
2-13-63	21.0
3-27-63	11.0
3-28-63	24.0
3-29-63	10.0
4-6-63	21.0
4-7-63	24.0
4-8-63	14.0
4-9-63	5.0
4-10-63	5.0
4-14-63	17.0
4-15-63	1.0
4-20-63	1.0

SPLUDE ROAD OVERFLOWS

Oct. 25, 1963 - May 22, 1964

Date of Overflow	Overflow (hrs.)
11-23-63	10.0
1-20-64	7.0
1-21-64	24.0
1-22-64	24.0
1-23-64	24.0
Oct. 30, 1964 to May 21, 1965	
11-10-64	9.0
11-11-64	2.5
12-21-64	24.0
12-22-64	24.0
12-23-64	24.0
12-24-64	24.0
12-25-64	13.0
12-26-64	14.0
12-27-64	24.0
12-28-64	24.0
12-29-64	24.0
12-30-64	24.0
12-31-64	6.0
1-2-65	6.0
1-3-65	24.0
1-4-65	23.5
1-5-65	24.0
1-6-65	15.0
1- 8-65	16.0
3-9-65	24.0

SPLUDE ROAD OVERFLOWS

Nov., 1965 to April, 1966

Date of Overflow	Overflow (Hrs.)
11-17-65	2.0
12-27-65	6.0
12-28-65	2.0
12-29-65	3.0
1-4-66	14.0
1-5-66	24.0
1-6-66	24.0
1-7-66	14.0
1-8-66	5.0
1-29-66	4.0
1-30-66	18.0
2-1-66	9.0
2-2-66	2.0
2-3-66	4.0
2-4-66	24.0
2-5-66	7.0
2-19-66	3.0

Sonoma Valley Infiltration Survey No. 1

Rain started with light sprinkles Fri. (1/11/57) noon, very little rain after 4:00 p.m. Fri. until 4:00 p.m. Saturday. It rained hard from around 4:00 p.m. Sat. until near midnight Sat. Few showers up until Sun. noon with little after. Klemmick and Bean photographed the following manholes Sunday morning (1/13/57) from 9:00 a.m. until noon:

2-36, 2-41, 2-60, 2-63, T-49, 1-9, 1-16, 1-21, 1-65, 1-64, 1-63, 1-62, 1-61, 1-69 1-70, T-74, 1-102, 1-103, 1-104, 1-14T, 1-138, T-77, 1-140, 1-137A, T-73, R.M.-1, Cecelia Ave. @ trunk and trunk at state home meter, T-51, Donaghy @ trunk, Rancho Madrone @ trunk, 1-14, 1-106.

1/13/57 (Sunday)

Date	Time Read	Rainfall Since last Observation (in.)		
		So. Val. Treat. Plant	El Verano Corp. Yd.	Santa Rosa Corp. Yard
1/11/57	8:00 a.m.		0.00	
(Fri)	12:00 N	0.00		0.00
	4:00 p.m.	0.20	---	---
	8:00 p.m.	---	---	0.50
	12:00 M	0.15	---	---
1/12/57	8:00 a.m.	0.00	0.55	
(Sat.)	12:00 N.	0.00		
	4:00 p.m.	0.40		
	8:00 p.m.	---		1.50
	12:00 M	1.25		
1/13/57	8:00 a.m.	0.20	2.20	
(Sun.)	12:00 N.	---		
	4:00 p.m.	0.05		
	8:00 p.m.	---		1.10
	12:00 M	0.25		
1/14/57	8:00 a.m.	0.00	0.35	
(Mon.)	12:00 N	---		
	4:00 p.m.	0.00		
	8:00 p.m.	---		0.06
	12:00 M	0.05		
1/15/57	8:00 a.m.	0.10	0.25	
(Tues)	12:00 N			
	4:00 p.m.			
	8:00 p.m.			

Sonoma Valley Infiltration Survey No. II

Started to rain in Sonoma City @ 7:00 p.m.

Started to rain at treat. plant @ 7:30 p.m.

Klemmick called me at my home at 12:50 a.m. Sunday and said flow was 3.4 M.G.D. and rising fast. Bob Bell and I left here at 1:30 a.m. We stopped at M.H. T 74 at Lake St. and trunk and took picture. Trunk was very near to surcharging. We took picture and proceeded to second M.H. (T25) below "Four corners" (Not counting one at corner) This was surcharged about six inches. We arrived at plant at about 2:30 a.m. Klemmick had just shut down headgate to by-pass plant. We called Gene to bring "bubbletrol" crew but after talking to him decided against it. Bell and I then left to take pictures. We observed and took pictures of the following surcharged manholes: T26, T38 & T40. We observed, investigated and took pictures of excessive flows from Grove St., Craig Ave., Arroyo and Calle del Monte Aves. Very little rain fell after 3:00 a.m. Except for picture at Lake St. & trunk no heavy rains occurred during time of picture taking.

1/20/57

Sonoma Treat. Plant (Accumulative rainfall)

12:00 midnite -	0.40 inc. Sat. night)
1:00 a.m.	0.75
2:00 a.m.	0.90
3:00 a.m.	1.00

Total rainfall @ El Verano = 1.60 in.

Total rainfall @ S.R. Corp. Yard = 1.10 in.

Klemmick observed the M.H. on outfall line from treat. plant (at entrance gate) to be surcharged 3/4 of its depth at 2:30 a.m., Sunday and 1/2 its depth at 7:30 a.m., Sunday

After surcharge receded heavy flow was noted from Grove St. at Riverside. Bel-aire, Lucas Ave., and Oak St. (All at Riverside) seemed normal at this time.

Klemmick and us synchronized our watches and read the H_2O surfaces simultaneously at Splude Rd. and at the by-pass at Treat. plant at 3:05 a.m. Sun. Distance down to H_2O at by-pass at plant (from top of structure) = 30¼". Distance down to H_2O from top of Splude Rd. overflow structure (top face of angle) = 5.30'.

Very light rain started at 8:00 a.m. in the morning. Started raining hard at 11:00 a.m. Gene & I left for Sonoma at 1:00 p.m. We got there about 2:30 p.m. Still raining pretty hard. Flow at plant = 2.3 M.G.D. Lake St. © trunk was flowing heavily. We took pictures in this area. Rain tapered off to nothing at 4:00 p.m.

Water Test of L.I.D. No. 1 Lines

Inlet to M.H. 139 was plugged. Water was added to M.H. 140 and the following readings taken

Time	Distance to H_2O Surf. From M.H. Lid Seat
11:51½ a.m.	46 3/4" (3.90)
12:04 p.m.	51" (4.25)

Note: at highest elev., H_2O was not visible in pipe at C.O. 140-1. Leakage observed around plug @ M.H. 139 (see photo)

$Q = (4.25 - 3.90)\ 94.0 = .35 \times 94.0 = \underline{32.9\ \text{gals}}$

$T = 12{:}04 - 11{:}51\tfrac{1}{2} = 12\tfrac{1}{2}$ min.

Since H_2O did not appear at C.O. 140-1, Vol. lost through drop in H_2O surf. in pipe from M.H. 140 to C.O. 140-1 may be calc. as follows:

$$Q = \frac{4.25-3.90}{.0040}\left(1.47\ \frac{\text{gal.}}{\text{ft.}}\right) = \frac{.35}{.0040} \times 1.47 = 129 \text{ gals.}$$

$$I = \frac{7{,}600{,}000\ Q}{DLT} = \frac{7{,}600{,}000\ (32.9+129)}{\left(\frac{280}{2} \times 6 + 605 \times 8\right)}\ 12.5$$

$$= \frac{760{,}000 \times 162}{(840+4840)12.5} = \frac{9{,}840{,}000}{5680} = 17{,}300 \text{ gals/in.mi.day}$$

Note: Above figure does not include domestic flow from houses connected and contributing during test nor does it include loss from drop in H_2O surf. in house services

2/14/57

Believe H_2O elev. was almost high enough to reach inv. @ C.O. (assume 1/2 length under test)

Reproduced from best available copy.

Inlet to M.H. 138 plugged, H_2O added to M.H. 141, observed to appear in C.O. 141-1

Time	Dist. to H_2O Surf. From M.H. Lid Seat
2:21½ p.m.	3.26 ft.
2:30 p.m.	4.06 ft.

Q = (4.06 = 3.26) 94.0 = 0.80x94.0 = 75.2 gals.

T = 150-141.5 - 8.5 min.

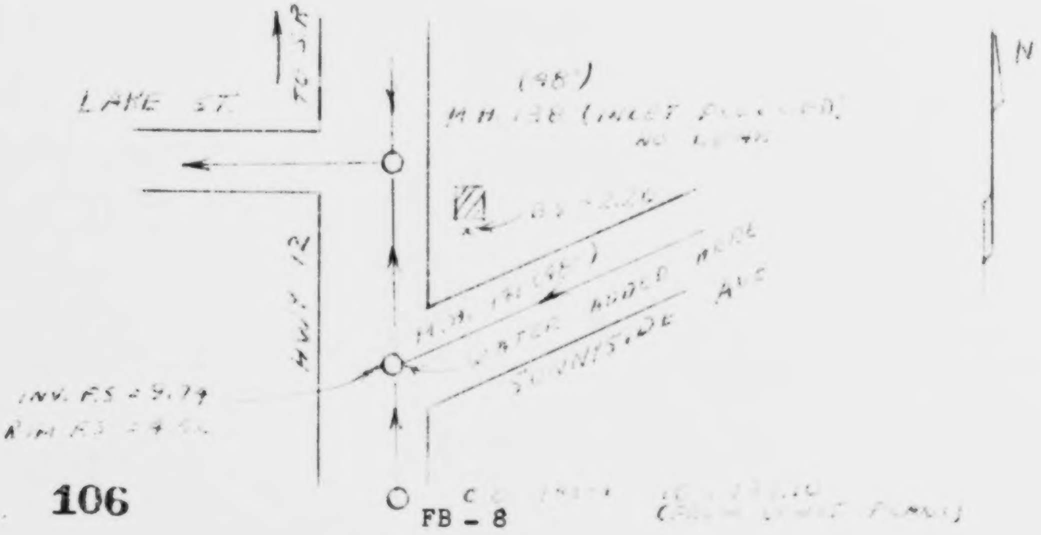
Loss drom drop in H_2O surf. in line between M.H. 141 and C.O. 141-1 may be calculated as follows: from const. plan elevs., low elev. on test was close to elev. of I.G. of C.O. 141-1. Assume lost vol. equal to 1/2 that if pipe were continuous past C.O. 141-1.

$$Q = \frac{4.06-3.26}{.0042} \times 1/2 \times 1/47 = \frac{.80}{.0042} \times 1/2 \times 1.47 = 140 \text{ gals.}$$

$$\text{and } I = \frac{7{,}600{,}000\ Q}{DLT} = \frac{7{,}600{,}000\ (75.2+140)}{6(520)85}$$

$$= \frac{7{,}600{,}000 \times 215}{26500} = 61{,}600 \text{ gal/in-mi-day}$$

Note: Above figure does not include domestic flow from houses connected and contributing during test nor does it include loss from drop in H_2O surface in house services.



LAKE ST.
(98')
M.H. 138 (INLET PLUGGED)
NO LEAK
HWY 12
WATER ADDED HERE
SUNNYSIDE AVE
INV. FS 29.79
C.O.
N

Outlet to M.H. 104 was plugged and H_2O added to M.H. 105.

Time	Dist. to H_2O Surf. From M.H. Lid Seat
3:16½	2.91 ft.
3:19	3.33 ft.

Q = (3.33-2.91) 94.0 = 0.42 x 94.0 - 39.5 gals

T = 199.0 - 196.5 - 2.5 min.

$$Q = \frac{7,600,000\ Q}{DLT} = \frac{7,600,000 x 39.5}{6 x 235 x 2.5} = 85,200 \text{ gal/in-diam/mi/day}$$

Note: This figure does not include domestic flow from houses connected and contributing during test nor does it include loss from drop in H_2O surface in house services

FB -9

Water test of 6 in. line on Hwy. 12 between Lake St. & Sunnyside Ave.

Inlet at M.H. 138 was plugged and inlets at M.H. 141 plugged. Water was added to M.H. 141 and the following readings taken.

Time		Dist. to H_2O Surf. From M.H. Lid Seat		
Min.	Sec.	First Test	Second Test	Third Test
0	0	3.53	3.45	3.80
0	30	---	3.61	3.89
1	0	3.93	3.78	4.00
1	30	4.13	3.90	4.06
2	00	---	3.99	4.11
2	30	---	4.10	---
Leakage during 1st minutes		.40x94= 37.6 gal	.33x94= 31.0 gals	.20x94= 18.8 gals.

Note: It took 1000 gals to fill line and complete 3 test lines holds 285/1.47 = 419 gals

First Test: $I = \frac{7,600,000\ Q}{DLT} = \frac{7,600,000 \times 37.6}{6 \times 285 \times 1} = \underline{167,000}$ gal/in-mi-day

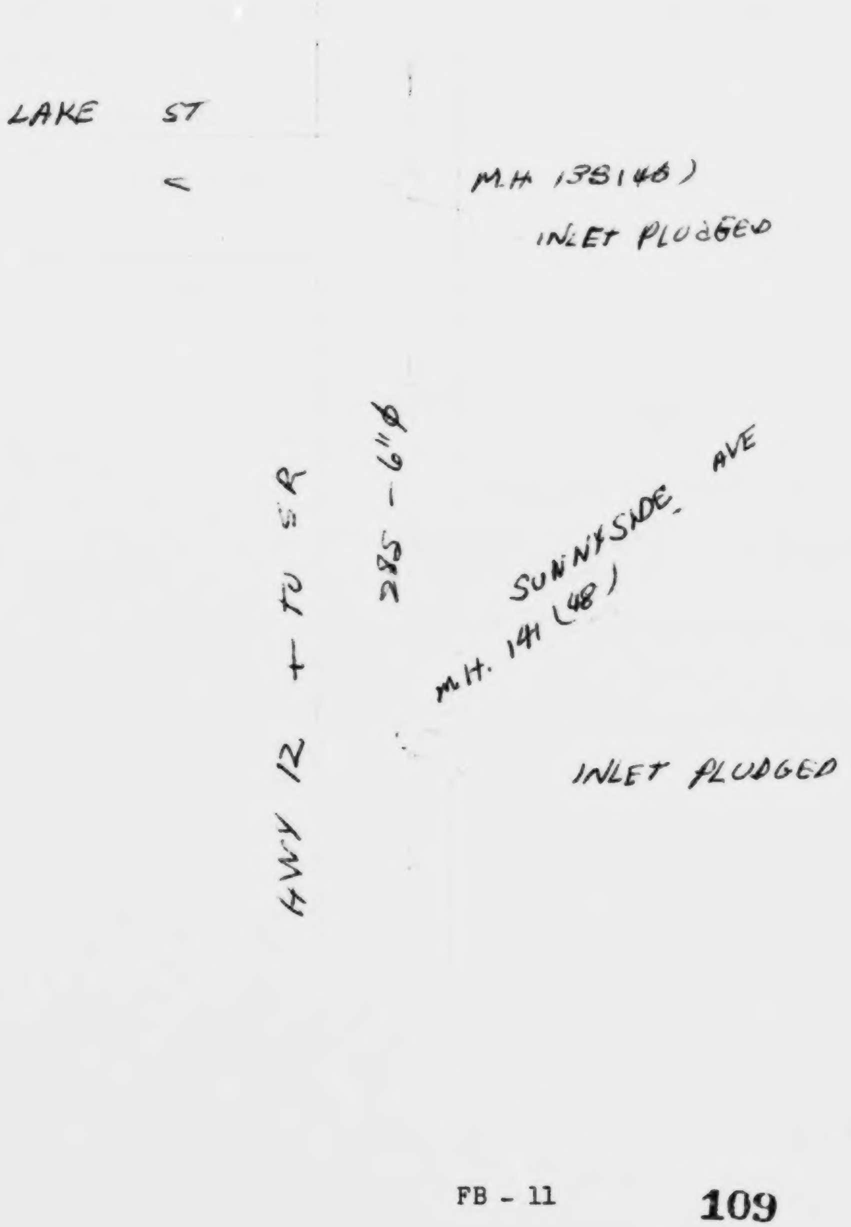
Second test: $I = \frac{7,600,000 \times 31.0}{6 \times 285 \times 1} = \underline{138,000}$ gals/in-diam-mi-day

Third test: $I = \frac{7,600,000 \times 18.8}{6 \times 285 \times 1} = \underline{83,500}$ gals/in-diam-mi-day

5E-24A

2/15/57
Clear & Warm

Bean
Camozzi
Goff
Klemmick
Frazier


LAKE ST
<
M.H 138(46)
INLET PLUDGED
HWY 12 + 70 S.R
285 - 6"φ
SUNNYSIDE AVE
M.H. 141 (48)
INLET PLUDGED

Water test of 6" line on Bay St.

Section between M.H. 58 & 57 was tested first by plugging inlet to M.H. 57 and inlet to M.H. 58 and then adding H_2O to M.H. 58. Water was added until it stood 6 ft. from top of M.H. Water was then cut off and level in M.H. allowed to drop. After a lapse of time water was again added until it stood at previous mark. Eight min. elapsed from time supply was cut off until H_2O level in M.H. was raised to previous mark. This dropped the H_2O level in the supply tank to 3/45 ft. from top. The second test on this section was done in the same manner. The drop in the supply tank was from 3.45 ft. to 3.57 ft. from top. Elapsed time = 5 min.

(When H_2O was first added to M.H. H_2O stood .07 ft. from top of supplt tank)

"Q" used to fill line = 740 gals.

$$\text{Calculated cap. of line} = 1.47\ \frac{(\text{gals})}{(\text{ft}\ \ )} \times 381 = 560 \text{ gals}$$

Loss during filling time = 740-560 = 180 gals.

$$\text{First test: } I = \frac{7{,}600{,}000\ Q}{DLT} = \frac{7{,}600{,}000\ (783-743)}{6(\text{in})\times 38(\text{ft})\times 8(\text{min})}$$

$$= \underline{16{,}600} \text{ gals/in.diam/mile/24 hr. day}$$

$$\text{Second test: } I = \frac{7{,}600{,}000\times 27}{6\times 381\times 5} = \underline{18{,}000} \text{ gals/in. diam/mi/day}$$

(See next pg. for test between M.H. 57 & 56)

5E-25A

2/20/57
Cool w/sprinkles

Bean
Goff
Sutton

111

Test Between M.H. 56 & 57

Test was conducted in manner outlined on previous pg. all inlets to M.H. 's 56 and 57 were plugged and H_2O added to M.H. 57.

Test No.	Dist. Down to H_2O in Supp. Tk.		Elapsed Time	Gals Used	Infiltra. Factor gals/in.d./mi./day
	Before	After			
#1	3.29	3.61	7¼ min.	819-746= 73	33,500
#2	3.61	3.99	6 5/6 min	892-819= 73	35,500

For possible future value the following readings were taken during time H_2O was first added to M.H.

Dist. Down to H_2O Supp. Tk.	Elapsed Time	
0.19	0 0/10 min.	119 gal/min
1.10	1 1/2 "	70 gal/min
1.39	2 1/2 "	96 gal/min
1.58	3 "	52 gal/min
1.68	3 1/2 "	132 gal/min
1.93	4 "	
2.10		84 gal/min
2.55	6 "	
2.97	8 "	55 gal/min. (line full)

667 Gals (560 req'd by calc.)

(Test #1)

$$\left(I = \frac{7{,}600{,}000\ Q}{DLT} = \frac{7{,}600{,}000x73}{6x381x7.25} \qquad 33{,}500\right)$$

(Test #2)

$$\left(I = \quad " \quad = \frac{7{,}600{,}000x73}{6x381x6.83} \qquad 35{,}500\right)$$

667 - 560 = 107 gals. used to fill line in 8 min.

$$I = \frac{7{,}600{,}000\ Q}{Dlt} = \frac{7{,}600{,}000x107}{6x381x8} = \underline{44{,}500}\ \text{gal/day etc.}$$

Note: for basis of So. Valley report use I = 42,000 gal/in-day-mi.

Bubbletrol and 3-D survey during storm from 2/20 to 2/24/57

Storm started with light sprinkles during day of 2/20, rained hard between 6 & 8 A.M. morning of 2/21. Causing flow to exceed 6 M.G.D. @ plant between 10:00 a.m. and 10:50 a.m. Rain declined to occasional showers the balance of 2/21 and during portions of 2/22. During evening of 2/22 rain and windstorm developed. Klemmick called me at 1:15 a.m. 2/23 and said flow was at 4.8 M.G.D. (1.8 from Sonoma) and rising fast. Gene & I left immediately and took Bubbletrol readings. Rain slacked off after we got there. Observed Splude Rd. overflowing at 3:40 a.m. Surcharge receded partially before daylight so we left for home early in morning of 2/23/57.

Bubbletrol Readings 2/23/57

Time	M.H.	H_2O Ht. Above Gage Tube Opening		Elev. Gage Tube Opening (2)	Water El. (1+2)
		In.	Ft(1)		
2:38 a.m.	2-68	40.5	3.38	68.39	71.77
2:40 a.m.	T-38	46.0	3.83	69.11	72.94
2:45 a.m.	T-63	No surcharge		78.27	—
2:55 a.m.	2-60	29.0	2.42	70.73	73.15
3:00 a.m.	T-27	2.5	0.21	45.53	45.74
3:06 a.m.	T-27A	10.0	0.83	43.97	44.80
3:10 a.m.	T-26	15.6	1.30	42.81	44.11
3:12 a.m.	T-25	6.9	0.58	41.59	42.17
3:16 a.m.	T-24	1.6	0.13	40.86	40.99
5:40 a.m.	T-26	No surcharge		42.81	
3:55 a.m.	(By-pass M.H. 10" from top)				
5:05 a.m.	(" " 3" " ")				
For 2/24/57					
10:06 a.m.	2-60	31.0	2.58	70.73	73.31
10:10 a.m.	T-38	44.0	3.67	69.11	72.78
10:13 a.m.	2-68	37.5	3.12	68.39	71.57
10:23 a.m.	T-27	7.5	0.62	45.53	46.15
10:25 a.m.	T-27A	15.6	1.30	43.97	45.27
10:27 a.m.	T-26	21.2	1.77	42.81	44.58
10:29 a.m.	T-25	10.0	0.83	41.59	42.42
10:31 a.m.	T-24	1.9	0.16	40.86	41.02
2:59 p.m.	2-60	32.2	2.68	70.73	73.41
1:02 p.m.	T-38	47.0	3.92	69.11	73.03
1:05 p.m.	2-68	42.3	3.52	68.39	71.91
1:13 p.m.	T-27	1.2	0.10	45.53	45.63
1:16 p.m.	T-27A	9.4	0.78	43.97	44.75
1:18 p.m.	T-26	16.2	1.35	42.81	44.16
1:20 p.m.	T-25	6.9	0.58	41.59	42.17
1:22 p.m.	T-24	0.6	0.05	40.86	40.91

Sun. morn. (2/24/57) at 7:30 I called plant. (It had been raining intermittently during 2/23 and during night) Bob said creek was high enough that it was just beginning to enter by-pass box. Gene & I left S.R. at 9:15 ran Bubbletrol down to four corners and then went to Splude Rd. and then treat. plant. Splude Rd. was overflowing as was by-pass box at plant. Creek at Splude Rd. was above outlet pipe, but had receded at plant back within its banks. We left treat. plant about 12:30 p.m. (2/24/57) and ran another Bubbletrol survey; then at lunch at El Verano and took pictures in L.I.D. 2. Came home by way of Rohnert Park. Looked in M.H. 2, H_2O was standing at 1/3 depth of line in M.H. 2 (no visible flow) pump was operating in M.H. 1 pumping out 5 gals/15 secs. (by meas.) onto grnd. Drain line from plant was contributing small amount (guessed at 2 gals/min.) We investigated flow and took picture of M.H. 25 - considerable flow.

Water in storm drain visible in open excavation on Allison near M.H. 25 was standing static approx. 1" below crown of pipe. Outlet of pipe in ditch at Highway was surcharged to crown of pipe (pictures taken)

We also took picture of M.H. at Stony Pt. on City trunk about 5:00 p.m. 2/24/57

Storm
2/26/57

5E-29

Rain started about 6:00 a.m. rained fairly heavy up to 11:00 a.m. Started hard again about 2:00 p.m. - Scheufel taking pictures all day. Had him pull top plank from Splude Rd. overflow. Didn't rain in Sonoma in P.M.

Occasional rain continued through Fri.

No rain Sat.

Rained quite a bit Sunday morning (3/3/57)

Splude Rd. Overflow Elevations

Sta.	BS	HI	FS	Elev.
BM 9	4.61	26.02		21.41
Top L W. Side			1.24	24.78
Top Board W Side			3.87	22.15
Top L E. Side			1.15	24.87
Top Board E Side			3.79	22.23
Outlet in Box			8.05	17.97
Top C.P.			6.52	19.50

See Sketch lower right for invert

BM 9	4.59	26.00		21.41
Top Copper			11.08	14.92
Inv. WRIR			4.60	21.40

Note: Steel plate cipolleti weir installed as of this date along w/bubbletrol tube for measuring head.

2/27/57 5E-30A

See Bk. 5 page 74

Bm 9 See field BK 5A P6

Shot taken on top of L that lid rests on, directly over baffle board on w side

Shot taken on baffle board with one board removed

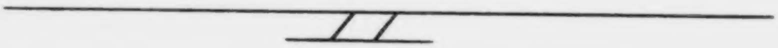
Overflow outlet in box

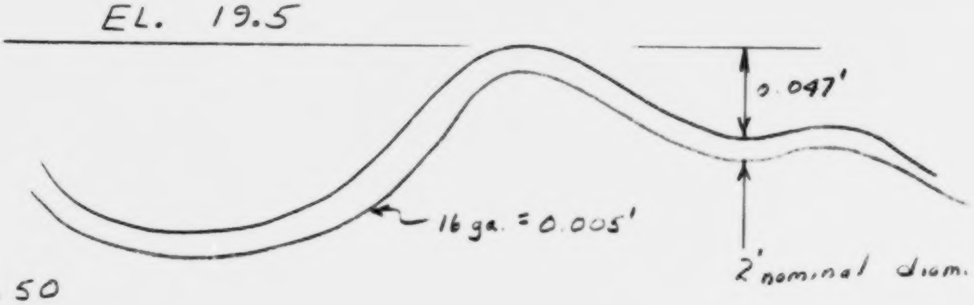
Shot taken on top 24" C.M.P. outfall at gate

3/4/57

Scheufel
Tripp
Cioffi

Top of copper tubing at lowest point in MH





19.50
2.05
17.45 ← INVERT OF SPLUDE ROAD
OVERFLOW INTO CREEK

Meas. @ Splude Rd. & Treat. plant after storm during night of 3/14/57-3/15/57

Rain started lightly about 7:00 p.m. 3/14/57. Total at plant between 8:00 a.m. 3/14/57 and midnight - 0.3. Total @ 8:00 a.m. 3/15/57 = 0.9 (for 24 hrs.)

Klemmick and Bob, from plant, took simultaneous readings at Splude Rd. weir and by-pass box at plant as follows:

3/15/57 Time	Dist. Down To H_2O By-Pass	Head at Weir Splude Rd.	Q = 3.33 LH 3/2 Calc. Flow
10:06 a.m.	17½"	1½"	.185 MGD
10:08 a.m.	17½"	1½"	.185 MGD
10:10 a.m.	(El. 15.42) 17"	1 3/4"	.228 MGD

Weir meas. were taken by placing wooden ruler vertically on top of weir crest and parallel to flow over weir

---

3/15/57 Time	Distance down to H_2O			Calc. Flow Orif. M.H. to M.H. B
	Eff. Box	Orif. M.H.	M.H. B	
10:18 a.m.	18" (H_2O El.= 15.59)	18" (H_2O El.= 15.42)	34" (H_2O El.= 14.92)	6.4 M.G.D.

Recorded flow at plant = 6 MGD

Measurement of Channel Depth in M.H. T95 (L.I.D. III)

Depth from shelf to inv. of 18 in. trunk = 1.17 ft. = 14 in. (at M.H. T95)

1/30/57 Scheufel and Cioffi - Cloudy

Time	Flow Depth	
9:35 a.m.	0.45 ft.	Determined by measuring from rim to inv. and subtracting dist. from rim to H_2O surf.
4:00 p.m.	0.39	

12:00 N - 2/4/58 - Flow depth = 0.60 ft. Goodman, Dykes, Bean

3:45 p.m. (see pix) " " " 0.40 ft.

2/5/58 " " 9.20-8.76=0.44 Rubenack & Goodman

9:54 a.m. 2/7/58 9.10-8.60=0.507 Bean, Klemmick & Stevenson

11:24 a.m. " " " (See pix) Bean & Stevenson

So. Valley Trench Widths

The following are observed measurements of apparent existing trench widths in So. Valley Sanit. Dist. Measurements were made where ground or street surface had subsided over trench leaving sides of trench plainly visible

L.I.D. I

Street	From M.H.	to M.H.	Trench Width
Northside Ave.	T67	1-60	30"
Willow Way	1-49	C.O. 49-1	30" (Very evident)
Mtn. Ave.	1-104	1-111	30"
Pine Ave.	1-53	1-54	30"
	1-54	C.O. 1-54-2	30"

L.I.D. II

St.	From	To	Trench Width
Cherry	M.H. 20	M.H. 21	24" (very evident)
Clayton	M.H. 19	M.H. 20	24"
Craig	M.H. 18	M.H. 19	24-26"
Riverside	Verano Ave.	M.H. 34	30" (very evident)
"	M.H. 35	M.H. 36	30" " "

5E-38A

4/10/57

Trunk Section I

St.	From	To	Trench Width
Northside	M.H. T66	M.H. T67	36"
R.R. R.O.W.	M.H. T76A	H.H. 76B	36"

Trunk Section II

St.	From	To	Trench Width	
State Home (Just so. of meter)			36"	(very evident)
In vicinity of M.H. T63			48"	(Not measured-so stated by Harold Ruebenack)

L.I.D. III - Martin St.   W=24"

Test of 6" V.C. sewer pipe taken from Lorna Dr. in So. Valley L.I.D. III approx. 25 ft. N.E. of M.H. 4

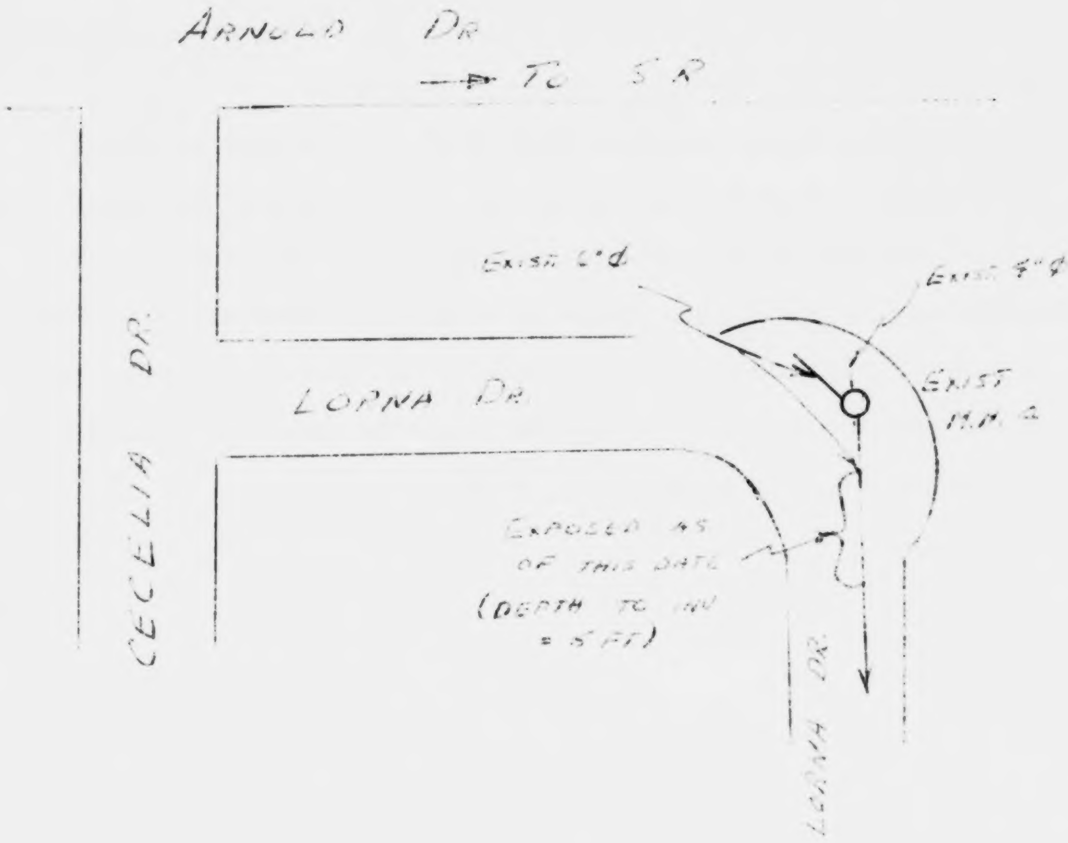
History - on 11/16/56, three joints immediately downstream from M.H. 4 were dug out because of root stoppage from nearby eucalyptus trees. These joints had badly cracked bells, penetrated by roots. The roots were removed and a block of concrete poured around each bell. Pictures were taken before pouring block.

About July 15 district forces uncovered about 35 ft. more or pipe (9 joints) beyond the original section for a better look at the condition of the joints. The pipe was st'd. strength, Gladding McBean, Bell and spigot, vit. clay in 3½ ft. laying lengths with mortar joints. Traces of oakum which appeared to have been dipped in neat portland cement grout were found in the joints. The mortar appeared dense but the bond with the pipe surfaces was poor. The joint had been protected after placing with a coat of a black sub- (cont. pg. 5E-40)

5E-39A

7/23/57

Dykes
Bean
Tripp


ARNOLD DR
→ TO S.R.
CECELIA DR.
LORNA DR.
EXIST 6"⌀
EXIST 8"⌀
EXIST M.H. 2
EXPOSED AS OF THIS DATE (DEPTH TO INV = 5 FT)
LORNA DR.

stance resembling tar. Of the 9 joints uncovered only two appeared to be sound. The balance of the joints had either cracked bells or the joint was thoroughly penetrated with roots or both. The downstream three lengths of pipe were removed for testing purposes. The joint between two of these sections was one of those appearing to be sound. It was preserved intact and brought back to the S.R. Corp. Yd. for testing purposes. The two sections of pipe were mounted in a vertical position, the lower end plugged and the pipes filled with H_2O. There was a drop in H_2O surfzce of 13 in. in 75 min.

$$I = \frac{7,600,000}{DLT} = \frac{7,600,000}{6 x 3.5 x 75}$$

$$= 4830 \text{ gal/in.diam./mi/24 hr. day}$$

$$\text{Rate } \left(\frac{\text{gal.}}{\text{day}}\right) = \frac{13/12 \text{ x } 1.47}{75} \text{ x } 1440 = 30.6 \text{ gal/day}$$

Pictures were taken of all joints after uncovering. The three sections replaced were jointed with C.P.I. 2 and a double hub. A conc. block 6" thick was poured around all joints including those replaced.

Even the joints that appeared good showed penetration by hairsize roots upon close examination. At places these fine roots could be seen penetrating even the walls of the pipe.

Condition of Joints

(Numbered from upstream end)
(Present excavation only)

Joint No.	Condition
1	Portion of bell cracked away on ea. side
2	Upper half of bell cracked away - badly penetrated by roots
3	Joint appeared good - fine roots were noticed penetrating mortar
4	Bell cracked on each side of crown and on left hand side (looking downstream)
5	Joint leaking, bad crack on left side. Mortar appeared to have been patched.
6	Piece cracked out of top of bell, pencil size root in joint
7	Appeared good - fine (hair size) roots in joint (this is joint referred to in H_2O test)
8	Bad crack in top of bell (bell of this joint saved at corp. yd)
9	Bell broken by digger - impossible to evaluate

Water test of 8 in. line on Spain St.

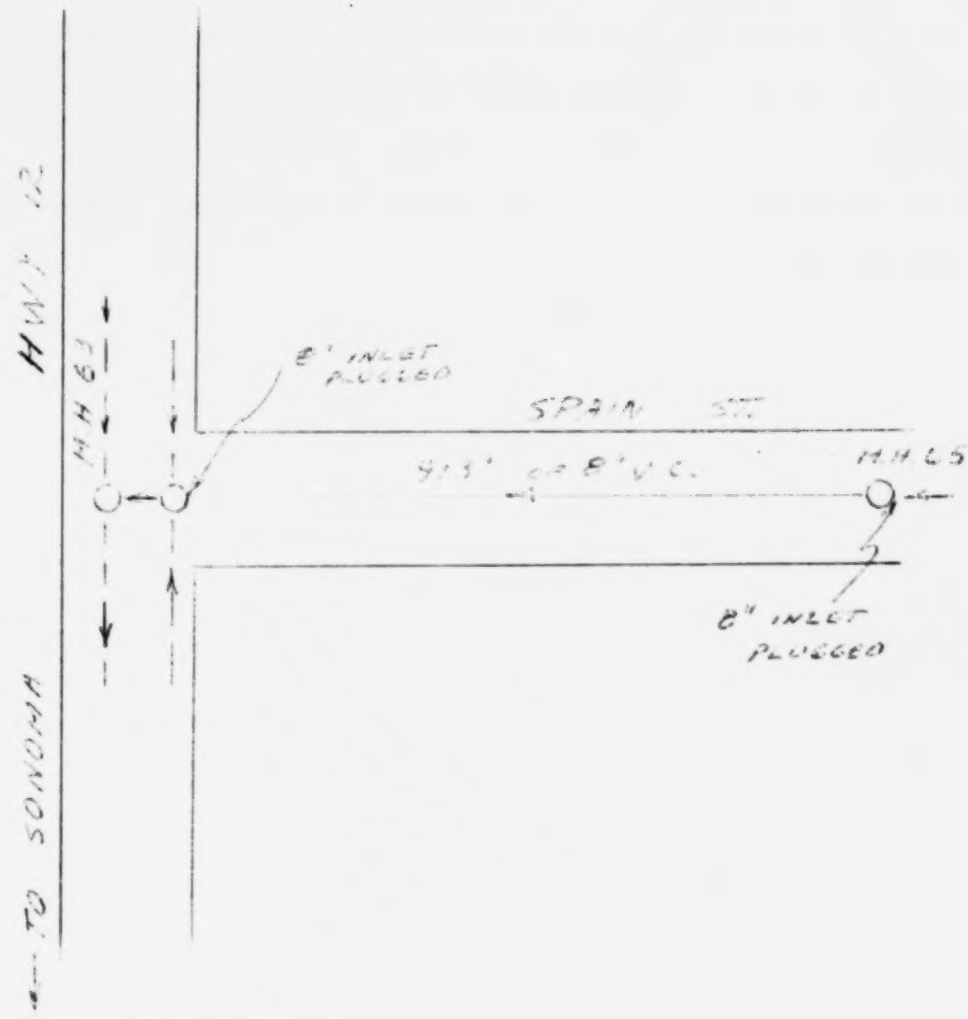
8 in. line on Spain St. (L.I.D. II) was tested by plugging its entrance at M.H. 64, its entrance at M.H. 65 and adding water at M.H. 65. Plug leaked slightly at M.H. 64 (1/2 gal/hr. by approx.) leakage was determined by blocking off M.H. channel 12 in. ± downstream from plug and determining time to fill channel to spring line. Capacity of line (not including connecting house services) = 913x2.61 = 2380 gals. 4,000 gals H_2O was used to fill line and make 3 tests.

Line was filled to 3.81 ft. below rim of M.H. to start test. Drop in H_2O surface at intervals of time are as follows:

Time	Dist. Down
1:42 p.m.	3.81
1:44	4.34
1:45	4.55
1:46	4.70

5E-41A

9/5/57
Clear & hot


HWY 12
TO SONOMA
M.H. 63
8" INLET PLUGGED
SPAIN ST.
413' OF 8" V.C.
M.H. 65
8" INLET PLUGGED

Water was then added to bring water surface back up to 3.81 feet from M.H. rim.

Time elapsed from start of test was (1:48-1:42) = 6 min.

Water surface in tank truck was 2.31 ft. from top of tank at start of test and 2.61 ft. at end of test or (573-492) = 81 gals.

$$I = \frac{7,600,000}{DxLxT} = \frac{7,600,000 \times 81}{8x913x6}$$

$$= \underline{14,050} \text{ gals/in.diam./mi./24 hr. day}$$

Water surface in M.H. was then allowed to drop again and then brought up to 3.81 ft. from top again. Time elapsed = 2:00-1:48) = 12 min.

Water surf. in tank = 3.49 ft. from top

Water used = 792-573=219 gals

$$I = \frac{7,600,000Q}{DxLxT} = \frac{7,600,000x219}{8x913.12}$$

$$= \underline{19,000} \text{ gals/in.diam./mi./24 hr. day}$$

A third test was performed in which time elapsed until H_2O surf. in M.H. brought back to starting pt. (3.81 from rim) = (2:06½-2:00) = 6½ min.

water surf. in tank at end of test was 4.20 ft. from top

H_2O used = 925-792 = 133 gals.

$$I = \frac{7,600,000Q}{DxLxT} = \frac{7,600,000x133}{8x913x6.5}$$

= 21,300 gals/in.diam/mile/24 hr. day

130

Solano Ave. Test

Tank No.	Time Started	Time Empty
1	9:58 ±	10:07 ±
2	10:13 ±	10:22 ±
3	10:36	10:45
4	11:01	11:10
5	11:23	11:32
6	11:44	11:53

Note: First three time records (marked ±)were arrived at by using elapsed time on other tests

Note: test was discontinued and water released after the sixth tank had been dumped because the line gave no indications of filling up. When plug in M.H. 41 was removed considerable water was observed to be stored in the line. There was no leakage from the plug in M.H. 41 and observed leakage at the creek crossing at approx. 2+60 cap. of line = 1220x2.61 = 38184 gals.

Total H_2O used (exc. of entering sewage) = 5712 gals.

Rate of hauling = $\frac{952}{25}$ = 38.1 G.P.M.

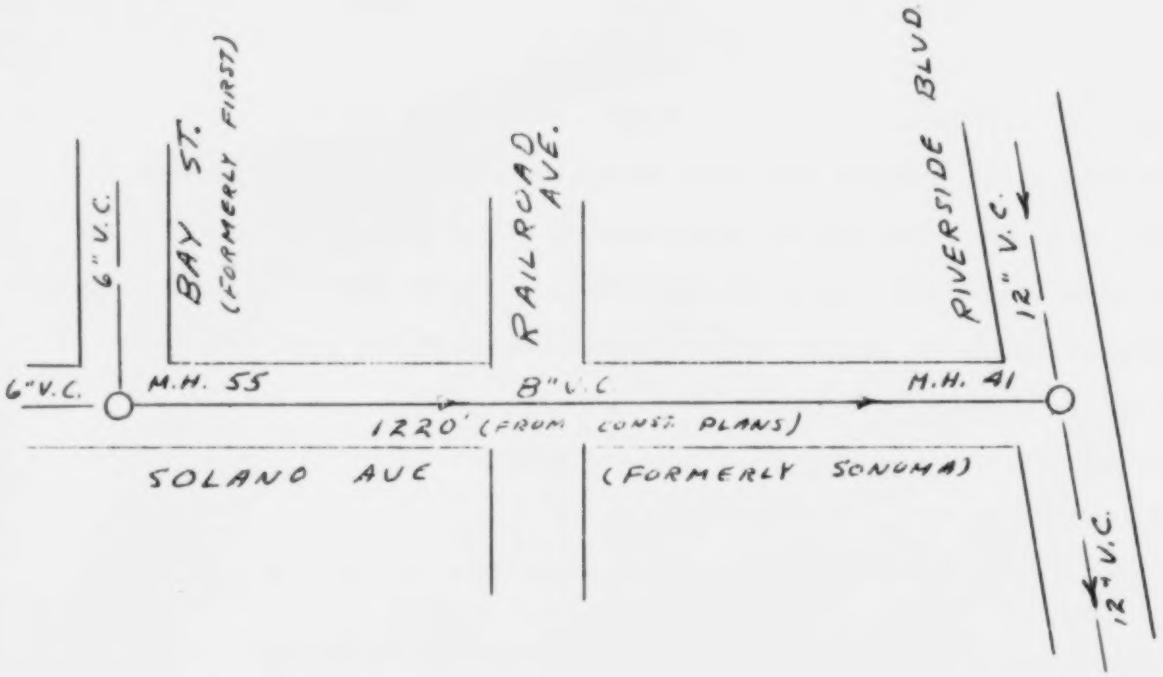
Assuming rate of adding H_2O just balance leakage rate; exfilt. = $\frac{7.6 \times 10^6 \times Q}{DLT}$

$= \frac{7.6x10^6x38.1}{8x1220x1} = \frac{290x10^6}{9760} = \underline{29,713}$ gals/in.diam/mi/24 hr. day

9/19/57

5E-43A

Test Method: End of line under test plugged at M.H. 41. Water was hauled by tank truck (Cap. = 952 gals.) from hydrant on Verano Ave. (in front of Pauls) and dumped in M.H. 55. Inlet lines to M.H. 55 were not plugged.


6" V.C.
BAY ST.
(FORMERLY FIRST)
RAILROAD AVE.
RIVERSIDE BLVD
12" V.C.
6" V.C.
M.H. 55
8" V.C
M.H. 41
1220' (FROM CONST. PLANS)
SOLANO AVE
(FORMERLY SONOMA)
12" V.C.

Note: Line under test shown in solid line

Note: See pg. 45 for retest of this line

Verano Ave. test

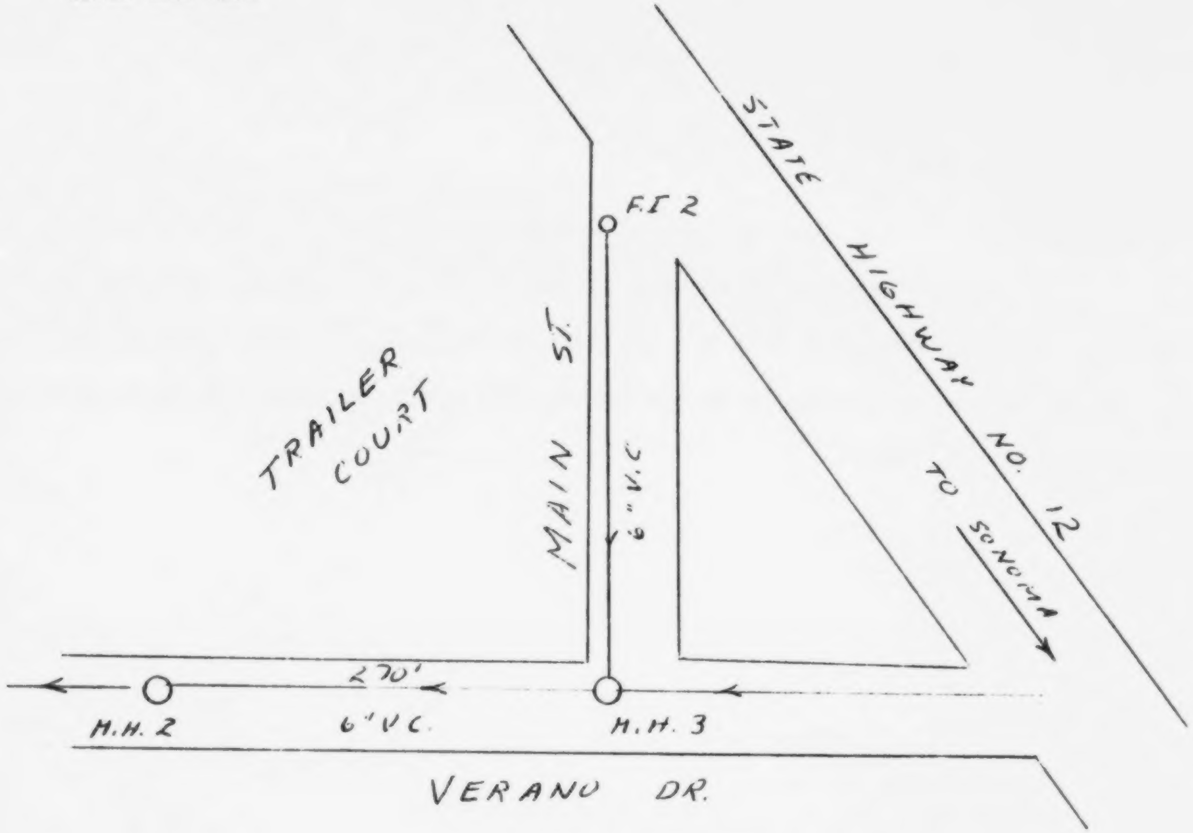
Tank No.	Time Started	Time Empty

Note: Water surf. in M.H. rose instead of dropping.

1½ tanks H_2O used. First try at testing failed because we forgot to put plugs in inlets of upstream M.H.'s we then let all H_2O out of line, put these plugs in and retested - water rose instead of dropping. Trailer court appears to be the only connection on this line.

5E-44A

9/19/57
Clear and warm


F.I. 2
STATE HIGHWAY NO. 12
TO SONOMA
MAIN ST.
6" V.C.
TRAILER COURT
270'
M.H. 2
6" V.C.
M.H. 3
VERANO DR.

Test Method: Inlet to M.H. 2 plugged; inlets to M.H. 3 plugged and H_2O added to M.H. 3. Line filled and tested with less than one tank of H_2O.

9/24/57

Retest of Solano Ave. line

Inlet to M.H. 41 plugged at 9:30 a.m.

Tank No.	Time Started	Time Empty
1	9:33 a.m.	9:42 a.m.
2	9:54	10:03
3	10:15	10:23½
4	10:34½	10:43
5	10:54	11:03
6	11:13½	11:22½
7	11:33	11:42
8	1:14	1:23½
9	1:34	1:43
10	1:54½	2:03½
11	2:14	2:23

Note: We were not able to fill this line. Roger Frazier had found a broken house service on the line after our test of 9/19/57 and had it repaired so the test was rerun as of this date.

5E-47

Test of Watmaugh Rd. P-B meter against Parshall meter at Treat. Plant

Test was run by placing dye in M.H. @ Watmaugh Rd., recording time and depth of flow and then recording time and depth of flow when dye reached plant. The writer was stationed at Watmaugh Rd. and Cioffi at treat. plant.

Test No.	At Watmaugh Rd.		At Treatment Plant			
			Dye First Seen		Dye at Peak	
	Time	Depth	Time	Staff Gage	Time	Staff Gage
1	1:42 p.m.	1.04	2:15	0.72	2:16	0.72
2	2:12	1.05	2:44½	0.73	2:45½	0.73
3	2:42	1.04	3:14½	0.75	3:15½	0.75
4	3:12	1.11	3:43	0.83	3:44	0.83
5	3:42	1.11	---	---	4:15	.88

12/2/57

Note: Depth of H_2O ahead of meter measured by meter stick and scale from known elev. at top of structure

.646 x cfs = MGD

1.547 x MGD = cfs

Dye Disappearing		Calc. Flow From Staff Gage (cfs)	Plant Flow Recorder		Watmaugh Rating Rating		
Time	Staff Gage		MGD	cfs	CFS	MGD	Ft. Diff.
2:17	0.72	2.43	1.500	2.32	2.70	1.75	+0.05
2:46½	0.73	2.48	1.550	2.40	2.75	1.78	+0.05
3:16½	0.76	2.58	1.600	2.48	2.70	1.75	+0.03
3:45	0.83	3.02	1.850	2.86	3.22	2.08	+0.04
--	--	3.29	1.850		3.22	2.08	+0.04

Watmaugh Rd. Meter Rating Test

Note: This test was conducted in same manner as that on previous pg. Goddman was stationed at plant; Bean at Watmaugh

	At Watmaugh Rd.				At Treat. Plant		
	Time	Depth	Calc. Flow		Time and Staff Gage Reading		
Test No.		(ft.)	cfs	MGD	Start	Peak	Decay
1	7:02	0.91	1.8	1.16	7:37 0.59	7:38 0.59	7:40 0.59
2	7:17	0.92	1.9	1.23	7:51 0.60	7:52 0.60	7:55 0.61
3	7:32	0.94	2.0	1.29	8:07 0.61	8:07 0.62	8:10 0.62
4	7:47	0.96	2.1	1.36	8:21 0.63	8:22 0.64	8:24 0.64
5	8:02	0.97	2.2	1.42	8:35 0.66	8:36 0.66	8:39 0.66
6	8:17	0.99	2.3	1.49	8:50 0.70	8:51 0.70	8:53 0.71
7	8:32	1.02	2.5	1.62	9:04 0.72	9:05 0.72	9:08 0.73
8	8:47	1.04	2.7	1.75	9:19 0.76	9:19 0.77	9:22 0.78
9	9:02	1.08	3.0	1.94	9:32 0.81	9:33 0.81	9:35 0.82
10	9:17	1.10	3.14	2.03	9:46 0.83	9:47 0.84	9:48 0.84
11	9:32	1.11	3.2	2.07	10:02 0.85	10:03 0.86	10:04 0.86
12	9:47	1.14	3.5	2.26	10:16 0.93	10:17 0.94	10:18 0.945
13	10:02	1.19	3.92	2.53	10:30 0.97	10:31 0.97	10:32 0.98
14	10:17	1.20	4.0	2.59	10:45 0.99	10:46 0.99	10:47 0.99
15	10:32	1.22	4.2	2.72	11:00 1.02	11:01 1.02	11:02 1.02
16	10:47	1.22	4.2	2.72	11:15 1.01	11:15 1.01	11:17 1.00
17	11:02	1.21	4.1	2.65	11:30 0.99	11:31 0.99	11:31 + 0.99
18	11:17	1.22	4.2	2.72	11:45 1.00	11:46 1.00	11:47 1.00
19	11:32	1.21	4.1	2.65	12:00 0.99	12:01 0.99	12:02 0.99

12/5/57

Calc. Flow at Peak		Plant Recorder at Peak	If Recorder is Correct Staff Gage would read:	Diff.-G.L.
CFS	MGD	MGD		
1.80	1.163	0.900	0.50	+09
1.84	1.189	0.950	0.52	+08
1.93	1.247	0.950	0.52	+.10
2.03	1.312	0.950	0.52	+.12
2.13	1.376	1.050	0.55	+.11
2.33	1.506	1.050	?	
2.43	1.571	*1.450	0.68	+.04
2.68	1.732	1.600	0.73	+.04
2.90	1.875	1.800	0.79	+.02
3.12	2.017	1.900	0.82	+.02
3.18	2.055	1.900	0.82	+.04
3.64	2.352	2.200	0.90	+.04
3.82	2.469	2.350	0.94	+.03
3.94	2.547	2.400	0.95	+.04
4.12	2.662	2.500	0.98	+.04
4.06	2.624	2.500	0.98	+.03
3.94	2.547	2.450	0.96	+.03
4.00	2.585	2.450	0.96	+.04
3.94	2.547	2.400+	0.95	+.04

*Fluctuating to 1.150 MGD

Note: Depth to H_2O surface ahead of meter measured with stick and scale from pt. of known elev. from top of structure.

Note: Depth readings at Watmaugh Rd. taken in same manner as tests on two previous pages. Accuracy of measurements on high flows was doubtful because of surface waves.

At Watmaugh Rd.					At Treat. Plant		
		Depth	Calc.	Flow	Time & Staff Gage Reading		
Test No.	Time	(ft)	cfs	MGD	Start	Peak	Delay
1	12:00 N	1.57(?)	8.1	5.24	10:25 1.80	12:25 1.80	12:26 1.80
2	12:19	1.50	7.3	4.72	12:43½ 1.56	12:44 1.56	12:44½ 1.56
3	12:30	1.51	7.4	4.78	12:54½ 1.53	12:55 1.53	12:55½ 1.53
4	12:45	1.51	7.4	4.78	1:09 3/4 1.50	1:10 ¼ 1.50	1:10 3/4 1.50
5	1:01	1.50	7.3	4.72	1:25 1.49	1:25½ 1.49	1:26 1.49
6	1:15	1.50	7.3	4.72	1:39½ 1.47	1:40 1.47	1:40½ 1.47
7	1:30	1.49	7.1	4.59	1:55½ 1.43	1:55 3/4 1.43	1:56¼ 1.43
8	1:45	1.44	6.55	4.23	2:10½ 1.38	2:10½ 1.38	2:11½ 1.38
9	2:00	1.44	6.55	4.23	2:24 3/4 1.38	2:25 1.38	2:26 1.38

12/16/57

Calc. Flow at Peak cfs	MGD	Plant Recorder at Peak	If Recorder is correct staff gage would read	Diff=G-L
9.82	6.35	5.90	1.72	+0.08
7.89	5.1	5.05	1.52	+0.04
7.65	4.95	4.85	1.51	+0.02
7.44	4.81	4.72	1.47	+0.03
7.43	4.80	4.65	1.47	+0.02
7.27	4.7	4.60	1.45	+0.02
6.96	4.5	4.4	1.42	+0.01
6.57	4.25	4.125	1.35	+0.03
6.57	4.25	4.1	1.35	+0.03

Watmaugh Rd. Meter Rating Test

note: Following test made by introducing dye sample at Watmaugh Rd., reading depth of flow with "Bubbler" pipe and reading flow at plant when dye sample arrived there.

At Watmaugh Road					At Treat. Plant			
Test No.	Time	Gage Read (spaces)	Depth (ft)	Calc. Flow (MGD)	Time	Staff Gage	Calc Flow	Recorder
1	7:30 am	10¼	1.12	2.13	8:02½	0.80	1.85	1.75
2	7:45	10¼	1.12	2.13	8:18	0.81	1.88	1.80
3	8:01	10+	1.11	2.09	8:33½	0.82	1.90	1.86
4	8:15	10+	1.11	2.09	8:47½	0.84	2:00	1.88
5	8:30	10½	1.14	2.24	9:02	0.86	2.05	1.90
6	8:45	10½	1.14	2.24	9:17	0.89	2.19	2.05
7	9:00	10½	1.14	2.24	9:31½	0.92	2.28	2.15
8	9:15	11¼	1.20	2.60	9:45½	0.96	2.45	2.30
9	9:30	11	1.18	2.48	10:00½	0.97	2.47	2.35
10	9:45	11 1/3	1.21	2.65	10:15½	0.98	2.52	2.42
11	10:00	11½	1.225	2.74	10:30½	1.03	2.75	2.55
12	10:15	12	1.27	3.03	10:44½	1.12	3.10	2.95
13	10:30	13	1.34	3.49	10:59	1.15	3.25	3.05
14	10:45	12¼	1.29	3.16	11:13½	1.16	3.28	3.10
15	11:00	12 2/3	1.32	3.35	11:29	1.15	3.25	3.06
16	11:15	13	1.34	3.49	11:43½	1.14	3.20	3.06
17	11:30	12 2/3	1.32	3.35	11:58½	1.16	3.28	3.10
18	11:45	13+	1.36	3.63	12:13½	1.16	3.28	3.10
19	12:00 N	13+	1.36	3.63	12:28½	3.15	3.15	3.00

1/8/58

If Parshall flume OK Watmaugh should be this Depth	Col J Col D	Watmaugh Chart (Note: Chart reading incorrect-see chart)
1.06	+.06	1.09
1.07	+.05	1.10
1.07	+.04	1.11
1.09	+.02	1.12
1.10	+.04	1.13
1.13	+.01	1.15
1.15	±.-1	1.17
1.18	+.02	1.19
1.18	+.00	1.20
1.19	+.02	1.21
1.23	+.00	1.24
1.28	-.01	1.27
1.30	+.04	1.30
1.31	+.02	1.29
1.30	+.02	1.29
1.30	+.04	1.29
1.31	+.01	1.29
1.31	+.02	--
1.29	+.07	--

1/10/58

Watmaugh Rd. Meter Rating Test

Note: Following test run in same manner as page 51 except that dye markers consisted of dye wrapped in paper towel, tied with rubber band. In most cases, arrival at plant was missed because towel did not break and remained in comm. sump without being discovered. At those times circled.

	At Watmaugh Rd.				At Treat. Plant			
Test No.	Time	Gage Read.	Depth (by Bubbler)	Depth(by chart)	Time	Staff Gage	Calc. Flow	Recorder
1	10:13 am	14	1.43 ft. 4.15 MGD	1.42 ft. 4.08	10:45	1.42	4.4	4.35
2	10:28	14½	1.47 4.46	1.43 4.15	10:52	1.43	4.5	4.43
3	10:43	14 3/4	1.49 4.61	1.44 4.22	11:01	1.45	4.6	4.50
4	10:58	14 3/4	1.49 4.61	1.44 4.22	11:28	1.45	4.6	4.50
5	10:13	14 3/4	1.49 4.61	1.44 4.22	11:39	1.44	4.55	4.48
6	11:28	14 3/4	1.49 4.61	1.44 4.22	12:00	1.42	4.4	4.57
7	11:43	14½	1.47 4.46	1.43 4.15	--	--	--	--
8	11:58	14½	1.47 4.46	1.43 4.15	12:23	1.40	4.35	4.30
9	12:13	14¼	1.45 4.30	1.43 4.15	12:40	1.40	4.35	4.29
10	12:28	14	1.43 4.15	1.42 4.08	12:55	1.38	4.25	4.22
11	12:43	13½	1.39 3.86	1.41 4.00	1:10	1.36	4.24	4.10
12	12:58							

Goodman realized dye should have arrived but hadn't been seen so he made reading anyway. After 12:00 N Goodman went to Watmaugh to tell Scheufel to leave small opening in packet. This was done and tests went O.K. from No. 8 on.

Measurements of surcharge in city of Sonoma lines leading to meter

During times of surcharge of district trunk, So. city meter was observed to be submerged at times and an effort to determine probably city flow was made by measuring ht. of surcharge in M.H. directly ahead of meter and at McArthur and Boradway.

Date	Time	District from top of M.H. Frame to H_2O Surf.		
		M.H. Ahead City Meter	M.H. at Mc Arthur & Broadway	
	(see pix)			
2/5/58	11:05 a.m.	running free	1.63 ft.	6.82-2.63 = 4.19 Ruebenack & Goodman
2/7/58	10:47		1.85	
	10:50	4.30		
	11:44		1.60	Bean & Stevenson
	11:48	4.40		
2/20/58	9:38 a.m.		2.30	
2/20/58	9:41 a.m.	6.39		Bean, Scheufel & Goodman

Note: Klemmick observed M.H. at McArthur & Donner in Sonoma, blowing at 10:30 a.m. Bean, Dykes, Ruebenack and Goodman observed this one also at 1:20 p.m. and one just west of McArthur & First (Mailbox no. 140) at same time. Both were blowing from 2 to 3 in. above top of lid.

Flow measurements (Bubbletrol) (Used to rate Watmaugh meter)

Note: The following measurements were made below "four corners" to calibrate Watmaugh meter. Test was run as follows: Bubbletrol reading made at M.H. T-25, then equipment moved to M.H. T-24 downstream. Before second bubbletrol reading was made dye charge was introduced into 24" pipe at M.H. T-25 at outlet of M.H. by use of specially constructed cylinder and plunger that gave instantaneous release of dye charge. Time of travel of dye between M.H.'s T25 and T24 was timed by stop watch. Elapsed time was considered ended at first sighting of dye at M.H. T24. This was considered accurate enough as M.H. T24

		H_2O Ht. Above Gage Tube		Elev. Gage Tube Open	H_2O Elev.		
Time	M.H.	In*	Ft.				
9:49½	T25	28¼	2.35	41.59	43.94	1.81	497
—	T24	15¼	1.27	40.86	42.13		
9:57½	T25	25¼	2.10	41.59	43.69	1.50	497
9:59½	T24	16	1.33	40.86	42.19		
10:09½	T25	26½	2.21	41.59	43.80	1.59	497
	T24	16¼	1.35	40.86	42.21		
10:40	T25	26 3/4	2.23	41.59	43.82	1.61	497
10:43	T24	16¼	1.35	40.86	42.21		

Note *H_2O ht. above gage tube openings represents gage reading. Constant of 2" should be added for actual H_2O elev.

FB - 51

1/24/58

was surcharged and it took a short interval of time for dye to find its way to surface in M.H. and also it was impossible to determine when max. density of dye arrived. Following release of dye charge and before its arrival at M.H. T24 Bubbletrol reading was taken at M.H. T24. Bubbletrol operator then stood by until dye arrived. Goodman was stationed at Watmaugh and recorded time of arrival of dye at that station. Manning formula used to compute flows. n used was 0.012

18" greater than $Q = \frac{.463}{n} d^{8/3} s^{\frac{1}{2}} = \frac{.463}{.012} (1.5)^{8/3} s^{\frac{1}{2}} = 38.6 \times 2.95 (s)^{\frac{1}{2}}$

21" greater than $Q = \frac{.463}{n} d^{8/3} s^{\frac{1}{2}} = \frac{.463}{.012} (1.75)^{8/3} s^{\frac{1}{2}} = 38.6 \times 4.45 (s)^{\frac{1}{2}}$

24" greater than $Q = \frac{.463}{n} d^{8/3} s^{\frac{1}{2}} = \frac{.463}{.013} (2) s^{\frac{1}{2}} = 38.6 \times 6.35 (s)^{\frac{1}{2}}$

$Q = Av$, $V = \frac{1}{t}$ $Q(15") = 70 s^{\frac{1}{2}}$

S	$s^{\frac{1}{2}}$	Q cfs	Q MGD	Q t (sec)	(By dye test) V = 1 ÷ t	A	Q=AV cfs	Q MGD	Arrival at Watmaugh	Depth at Watmaugh
.00364	.0603	14.8	9.55	107.6	4.62	3.14	14.5	9.37	10:06-10:06½	1.81
.00302	.0549	13.45	8.70	112	4.44	3.14	13.94	9.01	10:06½-10:17	1.81
.00320	.0565	13.85	8.95	110.2	4.51	3.14	14.17	9.15	10:27½-10:28	1.82
.00324	.0569	13.94	9.01	112	4.44	3.14	13.94	9.01	10:59	1.82

Bubbletrol Measurements

Time	M.H.	H_2O Ht. Above Gage Tube		El Gage Tube Open	H_2O El.
		(in)	(ft)		
11:31 am	T74	62	5.17	42.84	48.01
11:36	T73	56	4.67	40.35	45.02
11:48	2-63	42.5	3.54	78.27	81.81
11:55	T-38	91	7.58	69.11	76.69
11:59	2-60	111	9.25	70.73	79.98
12:02	T-38	112	9.33	69.11	78.44
12:02	T-38	112	9.33	69.11	78.44
12:12	2-68	118	9.83	68.39	78.22
12:24	T-27	38.5	3.21	45.53	48.74
12:27	T27A	40.5	3.38	43.97	47.55
12:27	T-27A	40.5	3.38	43.97	47.35
12:30	T-26	34	2.83	42.81	45.64
12:30	T-26	34	2.83	42.81	45.64
12:33	T-25	30.5	2.54	41.59	44.13
12:33	T-25	30.5	2.54	41.59	44.13
12:36	T-24	14	1.17	40.86	42.03

1/24/58 5E-58A

	1	S	$s^{\frac{1}{2}}$	Q (cfs)	Q MGD	Remarks
2.99	1083 18"	.00276	.0525	5.97	3.86	
5.12	747 21"	.00686	.0827	14.2	*9.18	5.71 MGD by "cut & try"
1.54	213'-12" 521'-15"	?	?	* 2.3	* 1.5	0.68 MGD by "cut & try"
0.22	475 21"	.000464	.0215	* 3.7	* 2.39	6.44 MGD by "cut & try"
1.39	800 24"	.00179	.0411	10.2	6.60	
1.71	515 24"	.00332	.0576	14.1	9.12+	
1.51	644 24"	.00235	.0485	11.9	7.69	City meter read. 2,375 MGD @ 12:30 p.m. (Not surcharged)
2.10	497 24"	.00421	.0649	15.9	10.3	10.30-7.69=3.70 MGD

* Note: These flows not reliable - results don't appear reasonable -perhaps due to insufficient press. used w/bubbletrol apparatus in MH's T38 and 2-68 which were badly surcharged - MH T38 14" from top. Bubbletrol pipe in T-38 had leak in it.

2/28/58. For solution of flows at this intersection see sketch on opp. pg.

$N_o$te: Add 2" to each bubbletrol reading to get actual depth.

+Note: ignore this value; believe tube broken in M.H. T26

So. City Engineer informed us that MH's were flowing in city (10:00 ±)

"Bubbletrol" measurements

MH's T73 and T74 were observed to start surcharing shortly before 3:00 p.m. but before crew could get there it had receded. T74 was observed free at 3:15 and 73 at 3:20 p.m.

Time	MH	H_2O Height above Gage Tube (in)	H_2O Height above Gage Tube (ft)	Elev. Gage Tube Opening	H_2O El.
3:30 pm	2-63	31	2.58	78.27	80.85
3:34	2-60	104	8.67	70.73	79.40
3:38	7-68	107	8.92	68.39	77.31
3:45	T-27	40	3.33	45.53	48.86
3:49	T-27A	43	3.58	43.97	47.55
3:53	T-26	13	1.08	42.81	43.81
3:55	T-25	33	2.75	41.59	44.34
3:59	T-24	22	1.83	40.86	42.69

1/29/58

5E-60A

Note: Add 2" to each bubbletrol reading to get actual depth.

	1	s	$s^{\frac{1}{2}}$	Q (cfs)	Q (mgd)
Note: See "cut and try" solution on opp. pg.					5.53
					1.07
					6.60
1.31	800'	.00164	.0405	9.04	6.43
Note: T26 elev. not reasonable - tube must be broken in M.H.					
1.65	497	.00332	.0576	14.1	9.14

City of Sonoma flows from Plant recorder:

Time	Flow
3:45	2.425 MGD
3:59	2.450
4:07	2.600
4:20 to 7:20	2.700

$$\begin{array}{r} 9.14 \\ \underline{6.43} \\ 2.71 \end{array}$$
MGD
(from bubbletrol)

"Bubbletrol" Measurements

Note: Measurements were made of flow depth on MH T95 as follows: 12:00 N - 0.60 ft.

3:45 p.m. = 0.40 ft.

M.H. T73 was not surcharged at 12:15 p.m.

Time	MH	H_2O Height Above Gage Tube (in)	(ft)	Elev. Gage Tube Opening	H_2O El.
12:31 p.m.	2-63	66	5.50	78.27	83.77
12:34	T-38	*	*	81.44+2.5 =	81.69
12:38½	2-68	140	11.67	68.39	80.06
12:42½	2-60	+137½	11.46	70.73	82.19
1:16 p.m.	T-27	68½	5.71	45.53	51.24
1:19½	T-26	69½	5.79	43.97	49.76
1:22	T-25	56	4.67	41.59	46.26
1:25	T-24	43	3.58	40.86	44.44
1:42	Splude Overflow	73	6.08	14.92	21.00
3:14	T27	67	5.58	45.53	51.11
3:16½	T27A	67 3/4	5.65	43.97	49.62
3:23½	T25	55	4.58	41.59	46.17
3:25½	T24	41¼	3.44	40.86	44.30

Note: During the time the series of measurements from 12:31 p.m. to 12:42½ were being taken district forces were repairing broken line on Clayton at M.H. 2-19 which passed below storm drain along N. side Craig. H_2O was entering excavation from storm drain and thence entering M.H. 2-19 through broken line (broken completely off at outside of M.H. 3" homelite pump was pumping from M.H. a stream which appeared to equal that entering from the storm drain. M.H.'s 2-19 and 2-17 were surcharged badly and to determine if flow was to or from M.H. 2-19 from 2-17 measurements to H_2O surfaces were taken: 1:00 p.m. M.H. 2-17, H_2O dn. 8.64 from top frame 12:50 (+) (See pix) M.H. 2-19, H_2) was 480 dn. from top MH frame

2/4/58 5E-61A

	e	S	$s^{\frac{1}{2}}$	Q (cfs)	Q (mgd)	Remarks
2.08	747	.00278	.0527	9.07	5.86	5.69 by "cut & try"
1.63	475	.00343	.0585	10.07	6.51	6.73 " "
0.50	734	.000681	.0261	1.83	1.18	1.04 " "
1.48	800	.00185	.043	10.5	6.79	
1.82	497	.00366	.0605	14.8	9.58	
(?)23.44	8129(?)	.00289	.0537	13.2	8.51 (?)	
1.49	800	.00186	.0431	10.57	6.83	
1.87	497	.00376	.0614	15.03	9.71	

Leak at M.H. 2-19 was sealed off by 2:00 p.m. H_2O elev. at Watmaugh at 1:35 p.m. was 5.98 ft. from seat of M.H. frame at N.E. bolt hole; no. lid.

At 3:35 p.m. H_2O was still bubbling thru lid holes to elev. approx. 1/2" above T38 lid

Flow Depth T95@ 12:00 N = 0.60 ft.

@ 3:45 p.m. 9.08 - 8.68 = 0.40 ft.

*Water was blowing 3" above top

+ " " ½ way through lid hole

FB - 58

"Bubbletrol" Measurements

Time	M.H.	H_2O Ht. Above Gage Tube (in)	(ft)	El. Gage Tube Opening	H_2O El.
9:45 am	T74	Not surcharged			
9:58	2-63	56½	4.71	78.27	82.98
10:00	T-38	143	11.92	69.11	* 81.03
10:05	2-68	133½	11.13	68.39	79.52
10:08	2-60	129½	10.79	70.73	81.52
10:19	T-27	71¼	5.94	45.53	51.47
10:21½	T-27A	72 3/4	6.06	43.97	50.03
10:24	T-25	58	4.83	41.59	46.42
10:28	T-24	43 3/4	3.65	40.86	44.51
10:35	2-63	55½	4.63	78.27	82.90
10:37	T-38	143½	11.96	69.11	+ 81.07
10:40	2-68	134	11.17	68.39	79.56
10:41½	2-60	139	10.75	70.73	81.48
10:47½	T-27	71 3/4	5.98	45.53	51.51
10:48½	T-27A	72½	6.04	43.97	50.01
10:50	T-25	58	4.83	41.59	46.42
10:51½	T-24	44	3.67	40.86	44.53
10:58	2-63	56¼	4.69	78.27	82.96
11:00	T-38	143½	11.96	69.11	** 81.07
11:02	2-68	134	11.17	68.39	79.56
11:05	2-60	128½	10.71	70.73	81.44
11:10	T-27	70½	5.87	45.53	51.40
11:11½	T-27A	71¼	5.94	43.97	49.91

*81.15 by "cut & try"

+81.13 " "

*81.14 by "cut and try"

2/7/58

	e	s	$s^{\frac{1}{2}}$	Q (cfs)	Q (MGD)	Remarks
1.95	747	.00261	.0510	8.77	5.67	Trunk approx. ½ full-8" line full 5.48 by "cut & try"
1.57	475	.00318	.0563	9.70	6.27	6.50 " "
0.49	734	.000668	.0258	1.80	1.17	1.01 " "
1.44	800	.0018	.0424	10.4	6.72	
1.91	497	.00384	.0619	15.2	9.82	City of Sonoma = 9.82-6.72 = 3.00 MGD
1.83	747	.00245	.0495	8.5	5.49	5.39 by "cut & Try"
1.51	475	.00318	.0563	9.68	6.26	6.38 " "
0.41	734	.000559	.0236	1.65	1.07	0.99 " "
1.50	800	.00188	.0434	10.6	6.87	
1.89	497	.00380	.0616	15.1	9.76	City of Sonoma = 9.76-6.87 = 2.89 MGD
1.89	747	.00253	.0503	8.65	5.59	5.47 by "cut & try"
1.51	475	.00318	.0564	9.69	6.26	6.40 " "
0.37	734	.000505	.0225	1.58	1.02	0.91 " "
1.49	800	.00186	.0431	10.6	6.85	
						City of Sonoma = 9.89-6.85=3.04 MGD

Time	MH	H_2O Ht. Above Gage Tube		El. Gage Tube Opening	H_2O El.
		(in)	(ft)		
11:13½ a.m.	T-25	58	4.83	41.59	46.42
11:15	T-24	43¼	3.60	40.86	44.46
1:15	2-63	34	2.83	78.27	81.10
1:19	T-38	126	10.50	69.11	* 79.61
1:21	2-68	115½	9.63	68.39	78.02
1:25	2-60	111	9.25	70.73	79.98
1:35	T-27	64	5.33	45.53	50.86
1:37	T-27A	65 3/4	5.48	43.97	49.45
1:40	T-25	52¼	4.35	41.59	45.94
1:44	T-24	39	3.25	40.86	44.11

*El. = 79.53 by "cut & try"

	e	s	$s^{\frac{1}{2}}$	Q (cfs)	Q (MGD)	Remarks
1.96	497	.00394	.0627	15.3	9.89	
1.49	747	.00200	.0447	7.70	4.97	5.08 by "cut & try"
1.59	475	.00335	.0579	9.96	6.44	6.22 by "cut & try"
0.37	734	.000505	.0225	1.58	1.02	1.11 by "
1.41	800	.00176	.0419	10.3	6.65	
1.83	497	.00368	.0606	14.9	9.63	City of Sonoma = 9.63-6.65 = 2.98 MGD

"Bubbletrol" Measurements

Time	MH	H_2O Height Above Gage Tube (in)	(ft)	El. Gage Tube Opening	H_2O Elev.
9:39	2-63	42¼	3.52	78.27	81.79
9:43	T38	135½	11.29	69.11	*80.40
9:45	2-68	126	10.50	68.39	78.89
9:48	2-60	122½	10.21	70.73	80.94
9:54	T27	73½	6.13	45.53	51.66
9:57	T27A	73½	6.13	43.97	50.10
9:59	T25	56	4.67	41.59	46.26
10:02	T24	40	3.33	40.86	44.19
10:11	2-63	48¼	4.02	78.27	82.29
10:14	T38	139	11.58	69.11	+80.69
10:15	2-68	130	10.83	68.39	79.22
10:18	2-60	125	10.42	70.73	81.15
10:23	T27	74 3/4	6.23	45.53	51.76
10:25	T27A	74	6.17	43.97	50.14
10:27	T25	56 3/4	4.73	41.59	46.32
10:29	T24	40½	3.37	40.86	44.23
10:51	2-63	46¼	3.85	78.27	82.12
10:54	T38	138½	11.54	69.11	**80.65
10:57	2-68	128 3/4	10.73	68.39	79.12
10:59	2-60	124	10.33	70.73	81.06
11:06	T27	74¼	6.19	45.53	51.72
11:08	T27A	74	6.17	43.97	50.14
11:10	T25	56	4.67	41.59	46.26
11:13	T24	40	3.33	40.86	44.19

2/10/58

	e	s	$s^{\frac{1}{2}}$	Q (cfs)	Q (MGD)	Q(MGD) by "cut & try" method	City of So. Flow (MGD)
1.39	747	.00186	.0431	7.42	4.79	4.87	
1.51	475	.00318	.0564	9.70	6.26	6.14	
0.54	734	.000736	.0271	1.90	1.23	1.28	
1.56	800	.00195	.0441	10.80	6.98		10.20-6.98= 3.22 MGD
2.07	497	.00416	.0645	15.80	10.20		
1.60	747	.00214	.0462	7.95	5.14	5.10	
1.47	475	.00310	.0556	9.56	6.18	6.20	
0.46	734	.000627	.0250	1.75	1.13	1.13	
1.62	800	.00203	.0450	11.00	7.10		10.30-7.10= 3.20 MGD
2.09	497	.00420	.0648	15.90	10.30		
1.47	747	.00197	.0444	7.64	4.94	5.02	
1.53	475	.00322	.0566	9.75	6.30	6.16	
0.41	734	.000559	.0236	1.65	1.07	1.14	
1.58	800	.00198	.0445	10.90	7.05		10.20-7.05= 3.15 MGD
2.07	497	.00416	.0645	15.80	10.20		

*80.35 by "cut & try"
+80.71 " "
**80.59 " "

"Bubbletrol" Measurements

Time	M.H.	H_2O Ht. Above Gage Tube		El. Gage Tube Opening	H_2O Elev.
		(in)	(ft)		
2:30	T38	Not surcharged			
2:38	T27	13	1.08	45.53	46.61
2:40	T27A	20¼	1.69	43.97	45.66
2:43	T25	17¼	1.44	41.59	43.03
2:44	T24	8¼	0.69	40.86	41.55
2:47	T27	13¼	1.10	45.53	46.63
2:48	T27A	20¼	1.69	43.97	45.66
2:50	T25	17½	1.46	41.59	43.05
2:51	T24	8¼	0.69	40.86	41.55
2:54	T27	13½	1.12	45.53	46.65
2:55	T27A	20¼	1.69	43.97	45.66
2:57	T25	17½	1.46	41.59	43.05
2:58	T24	8¼	0.69	40.86	41.55
3:17	Splude flap gate open approx. 2"				
3:48	T27	12 3/4	1.06	45.53	46.59
3:49	T27A	19 3/4	1.65	43.97	45.62
3:51	T25	16 3/4	1.40	41.59	42.99
3:53	T24	8	0.67	40.86	41.53
3:55	T27	12¼	1.02	45.53	46.55
3:57	T27A	19½	1.63	43.97	45.60
3:59	T25	16 3/4	1.40	41.59	42.99
4:01	T24	8	0.67	40.86	41.53

5E-65A

2/11/58

	e	s	$s^{\frac{1}{2}}$	Q (cfs)	Q (MGD)	City of Sonoma (MGD)
0.85	800	.00106	.0325	7.95	5.14	
1.48	497	.00298	.0545	13.3	8.60	8.60-5.14= 3.46
0.87	800	.00109	.0330	8.08	5.22	
1.50	497	.00302	.0549	13.4	8.66	8.66-5.22 = 3.41
0.89	800	.00111	.0333	8.15	5.26	
1.50	497	.00302	.0549	13.4	8.66	8.66-5.26 = 3.40
0.97	800	.00121	.0348	8.52	5.51	
1.46	497	.00294	.0541	13.2	8.53	8.53-5.57= 3.02
0.95	800	.00119	.0345	8.45	5.46	
1.46	497	.00294	.0541	13.2	8.53	8.53-5.46= 3.07

Note: So. City meter read 2.150 MGD over this period

Bubbletrol Measurements

Time	M.H.	H_2O Ht. Above Gage Tube (in)	(ft)	El. Gage Tube Opening	H_2O Elev.
2:00	T74&T73	No surcharge			
2:04	2-63	68	5.67	78.27	83.94
2:07	2-60	Overflowing		70.73	
2:10	T38	"		80.40	
2:15	T27	54½	4.54	45.53	50.07
2:17	T27A	54½	4.54	43.97	48.51
2:20	T25	40	3.33	41.59	44.92
2:22	T24	27 3/4	2.31	40.86	43.19
3:23	2-63	67½	5.62	78.27	83.89
3:25	2-60	Overflowing		70.73	
3:26	T38	"		80.40	
3:28	2-68	142½	11.88	68.39	80.27
3:38	T27	52¼	4.25	45.53	49.88
3:35	T27A	52½	4.37	43.97	48.34

2/19/58

	e	s	$s^{\frac{1}{2}}$	Q (cfs)	Q (mgd)	City of Sonoma (mgd)
1.56	800	.00195	.0441	10.8	6.98	9.34-6.98=2.36
1.73	497	.00348	.0590	14.45	9.34	
1.54	800	.00193	.0439	10.75	6.95	

2/26/58

Observations on Riverside Trunk

Observations on lower reaches of Riverside trunk in morning revealed surcharges there. In the afternoon M.H. 60 was seen to be running free but M.H. 41 above was surcharged. M.H.'s above this were running free. This would indicate flow exceeded capacity of line between No.'s 60 and 41 but was below capacity of others.

4/2/58

Observations on Overflowing Trunkline M.H.'s

Roger Frazier observed M.H.'s T38, T44 and T53 to be overflowing. Observations were made at each of these in close order, so that M.H.'s assumed to be all overflowing at once. These observations made about 10:00 a.m. before failure of Riverside Dr. crossing. After crossing failure, T38 observed to quit overflowing. Other two M.H.'s not observed after failure. M.H.'s T38 and T44 were observed to be overflowing at about 9:00 a.m.

Water Test - Davidson St. between Barrett Ave. and Brooks (before subgrade asphalt treat.

Time	Depth to H_2O in Truck Tank	Vol (Gals) Above H_2O Surface	H_2O Used	Elapsed Time	Remarks
9:40 a.m.	0.57 ft.	70 gals.		---	Start Test No. 1
9:45 a.m.	2.70	596	526 gals.	5 min.	M.H. filled to 4.24' Dn. from rim Seat
10:05 a.m.	3.16	714	118	20	M.H. refilled to 4.24' after making test(end Test #1-Start test #2)
10:24	3.59	814	100	19	M.H. refilled to 4.24' dn. after making test (end test #2)

Test No. 1

$$Q = \frac{7.6x10^6\ Q}{DLT} = \frac{7.6x10^6 x118}{6x229x20} = 32{,}600 \text{ gpd/in.diam.-mi.}$$

$$Q = \frac{7.6x10^6\ Q}{DLT} = \frac{7.6x10^6 x100}{6x229x19} = 29{,}100 \text{ gpd/in.diam.-mi.}$$

Test No. 1 (observations H_2O El. in M.H. 16)

Time	Reading	Change	Time	Reading	Change
9:45 a.m.	4.24 ft.			4.66	.05
	4.32	.08		4.70	.04
	4.35	.03		4.72	.02
	4.39	.04		4.75	.03
	4.41	.02		4.80	.05
	4.45	.04		4.81	.01
	4.49	.04		4.86	.05
	4.52	.03		4.89	.03
	4.54	.02		4.90	.01
	4.60	.06		4.93	.03
	4.61	.01		4.95	.02

5/27/58 - Cloudy and mild

Dykes
Bean
Camozzi

Note: inlet to M.H. 13 plugged at 9:09 a.m.

WATER ADDED
AT M.H. 16
INLETS PLUGGED

Note: For "as-built" notes on this sewer see field bk. 5G, pg. 46 (5/26/58)

*Reading of H_2O el. in M.H. 16 taken down from M.H. seat to H_2O surface.

+This reading not used in summation of changes

Test No. 1 (contd)			Test No. 2		
Time	Read	Change	Time	Read.	Change
	5.00	.05		4.33	
	5.01	.01		4.40	.07
	5.04	.03		4.49	.09
	5.06	.02		4.54	.05
	5.10	.04		4.60	.06
	5.11	.01		4.68	.08
	5.15	.04		4.72	.04
	5.19	.04		4.80	.08
	5.20	.01		4.84	.04
	5.24	.04		4.90	.06
5	5.26	.02		4.98	.08
	5.28	.02		5.01	.03
		= 0.96		5.08	.07
				5.12	.04
				5.18	.04
				5.23	.05

Aug. = $\frac{.96}{32}$ = .03 ft.

Aug. leakage = 0.03x94.0

= 2.82 gals/30 sec.

$$I = \frac{2 \times 2.82 \times 60 \times 24}{6 \times \frac{229}{5280}}$$

$$= \frac{8120}{.260} = 31{,}200 \text{ gpd/in. diam-mi.}$$

Aug. = $\frac{.90}{15}$ = .06 ft./

Note: Aug. drop = that of test No. 1; there

I - 31,200 gpd/in.diam.-mi.

Water Test-Davidson St. between Barrett Ave. and Brooks (After experiment with sealing of leaks by external subgrade application of hot asphalt & SS-1)

Note - See field bk. 5G for report on sealing process. See pg. 70, this bk. for H_2O test before asphalt treatment and sketch of area. Test was conducted in same manner as that shown on pg. 70.

Time	Depth to H_2O in Tank Truck	Vol. (gal) Above H_2O Surface	H_2O Used	Time Elapsed	Remarks
9:28 a.m.	0.70	94	—	--	Started filling M.H. 16
9:34½	2.80	623	529	7 min.	4.61 ft.
10:38	3.34	758	135	63 min.	M.H. refilled to depth at start of test (4.62 ft.)

Observations H_2O El. in M.H. 16

Time	Read.	Change	Time	Read	Change
9:34½	4.61	—	9:40½	4.81	.01
9:35	4.62	.01		4.82	.01
	4.64	.02		4.84	.02
	4.67	.03		4.85	.01
	4.68	.01		4.86	.01
	4.70	.02		4.88	.02
	4.71	.01		4.89	.01
	4.73	.02		4.90	.01
	4.74	.01		4.92	.02
	4.77	.03		4.93	.01
	4.78	.01		4.95	.02
9:40	4.80	.02	9:46	4.96	.01
					.34

6/20/58

$$I = \frac{7.6 \times 10^6\,Q}{DLT} = \frac{7.6 \times 10^6 \times 135}{6 \times 229.1 \times 63}$$

= 11,840 gpd/in diam.-mi.

(By observation of H_2O used to refill M.H. to that at depth at start of test)

Exfilt. by observed drop in H_2O surface

$$I = \frac{7.6 \times 10^6\,Q}{DLT} = \frac{7.6 \times 10^6 \times 34 \times 94}{6 \times 229.1 \times 11}$$

= 16,100 gpd/in.diam.-mi. (for first 11 Min.

Note - Approx. 1/2 of this line was treated with RS-1 and the balance w/380° hot asphalt externally and in place before testing, See bk. 5G

Time	Read.	Change	Time	Read.	Change
9:46½	4.97	.01	9:58½	5.27	.01
	4.99	.02		5.29	.02
	5.00	.01		5.30	.01
	5.01	.01		5.31	.01
	5.03	.02		5.32	.01
	5.04	.01		5.34	.02
	5.05	.01		5.35	.01
	5.07	.02		5.36	.01
	5.08	.01		5.37	.01
9:51	5.09	.01		5.38	.01
	5.10	.01		5.39	.01
	5.12	.02		5.40	.01
	5.12	.00		5.42	.02
	5.14	.02	10:05	5.42	.00
	5.15	.01	10:11½	5.57	.15
	5.16	.01	10:13	5.60	.03
	5.18	.02	10:13½	5.61	.01
	5.19	.01	10:14	5.62	.01
	5.20	.01	10:14½	5.63	.01
	5.21	.01	10:25	5.84	.01
	5.22	.01	10:25½	5.85	.01
	5.23	.01	10:26	5.86	.01
	5.25	.02	10:34	6.01	.15
9:58 a.m.	5.26	.01	10:34½	6.01	.00
			10:35	6.02	.01
					1.40

Exfilt. for first 16 min. by observed drop in H_2O surf. in M.H. 16

$$I = \frac{7.6\text{x}10^6\ Q}{DLT} = \frac{7.6 \text{ x } 10^6 \text{ x } (5.9-4.62)94}{6\text{x}229.1\text{x}16}$$

$$= \frac{7.6\text{x}10^6\text{x}0.47\text{x}94}{6\text{x}229.1\text{x}16} = 15{,}300 \text{ gpd/in.diam.mi.}$$

Note: This compares with 31,200 figure obtained before treating (see pg. 71) for first 16 min.

Exfilt. for whole period

$$I = \frac{7.6\text{x}10^6\ Q}{DLT} = \frac{7.6\text{x}10^6\text{x}1.40\text{x}94}{6\text{x}229.1\text{x}60}$$

$$= 12{,}130 \text{ gpd/in.diam.mi.}$$

Water Test-Between Boyes Blvd. and Myrtle Ave.   MH 47 to MH47A

Arrived at 0:900 tank truck and work crew already there. Started plugging M.H. #74 at 09:05. There was about 1" flow in trunk line before being plugged; the mainline had about 2" of flow. M.H. #47 had so much dirt on sides one could not tell if there were any cracks high up in bell section. Lower section looked pretty good before test. Note the difference in invert elevation is only 1.57' fall for 259.8 very flat line. At MH 47A good walls clean. Good after test. Flow before plugged 1/4" deep in 6" line. Vol. of H_2O needed to fill line and MH47A 259.9X $(3)^2$/144x7.4=399.6

$(1.5)^2$ 2.5x7.4=145.3 gallons in M.H. #97A Total 512.9 gallons roughly needed.

Note water line did not fall appreciably and Mr. Anderson felt line sufficiently good as not to warrant additional testing. One one time recorded and this was thrown out because

Reichert
Goodman
Kafka
Ward
Doss
Anderson

there was an air pocket in line

09:00 Weather
Clear 55°

Test No.	
1	2'46" - Air pocket - no good for calculation
2	Length of time sufficient as not to warrant additional testing.

Type of pipe used V.C. 6" dia.

Joint type C.P. 1 Length 259.9'

Estimate material around pipe to be O.G. and wet

Stopped at 10:30 a.m.

Note line had been brushed out 3/1/66

Field Notes 5G-1

Thomson East of 4th St.

M.H.	(B.S.)	(H.I.)	(F.S.)	(Elev.)	
1-17	7.52	162.52		155.00	Assumed Rim
			15.32	147.20	Invert E
1-17	8.60	163.60		155.00	Rim
1-18			0.68	162.92	Rim
			7.46	156.14	Invert W

1-17	5.38	160.38		155.00	Rim
**Test Pipe			4.32	156.06	Edge Coupling

Depth of pipe to coupling 7.80 use for first 3 readings pg. 2 (invert 148.26)

3/19/58

1-17	5.43	160.43		155.00	Assumed
			4.25	156.18	Top of conc. slab
Inv.			12.05	148.38	of pipe

Use for final inv. of test pipe

5G-1A

INFILTRATION TEST PIPE 3-10-58

3-18-58

Dye dropped into pipe. Stop watch started. At 0:02 about 100 gals. of water was used to wash dye out of pipe into ditch. At 0:15 a trace of dye appeared in M.H. 1-17. At 0:19 water entering MH 1-17 was saturated with dye.

3-25-58

0:00 Dye
0:02 Water
0:08 Trace
0:10 Saturated

see pg. 2

Thomson E. of 4th St.

Date	Reading	H_2O Depth	H_2O Elev.	Weather	Height Above Invert
3-10-58	---	**1.30	149.56	Dry	0.72
3-12-58	6.23	**1.57	149.83	Dry	0.99
3-13-58	6.25	**1.55	149.81	Dry	0.97

Date	Top of Slab (H.I.)	Reading (F.S.) Subtract from (top of slab)	H_2O Elev.	Time	
3-20-58	156.18	5.68	150.00		0.05" Rain 1.66
3-21-58		4.35	151.83		2.99
3-24-58		4.90	151.28	3:00	2.44
3-25-58		5.00	151.18		2.34
3-31-58		5.45	150.78		1.94
4-11-58		5.77	150.41		1.57
4-17-58		6.05	150.13		1.29
4-21-58		6.02	150.16		1.32
4-28-58		6.25	149.93		1.09
5-5-58		6.30	149.88		1.04
5-9-58		6.45	147.73		0.89
5-20-58		6.65	149.53		0.69
5-26-58		6.40	149.78		0.94
6-4-58		6.50	149.68		0.84
12-26-58		7.37	148.81		
12-29-58		7.35	148.83		
1-2-59		7.30	148.88		0.04
1-6-59		6.60	149.58		0.74
1-9-59		5.00	151.18		2.34
1-14-59		5.55	150.63		1.79

**See page 1
FB - 82

Assumed invert ofsewer line 148.84

148.84 Inv. sewer

Thompson East of 4th Street

Date	Top of Slab	Reading (Subtract from top of Slab)	H_2O Elev.	Ht. Above Invert
1-26-59	156.18	5.90	150.28	1.44
2-2-59		6.43	149.75	0.91
2-13-59		6.00	150.18	1.34
2-20-59		4.65	151.53	2.69
2-27-59		6.23	149.95	1.11
3-6-59		6.38	149.80	0.96
3-13-59		6.48	149.70	0.86
3-20-59		6.55	149.63	0.79
4-3-59		6.50	149.68	0.84
4-10-59		6.70	149.48	0.64
4-17-59		7.00	149.18	0.34
4-27-59		7.25	148.93	0.09

Arroyo and Vallejo

(M.H.)	(B.S.)	(H.I.)	(F.S.)	(Elev.)	
1-88	4.74	146.44		142.70 (Assumed)	Rim
			12.85	133.59	E. Inv.
**Test Pipe			5.12	141.32	Edge Coupling
1-89			3.39	143.05	Rim
			11.82	134.62	W. Inv.

**Depth of pipe to coupling 7.10 use for first 3 readings pg. 7 (invert 134.22)

3-19-58

1-88	4.69	147.39		142.70 (Assumed)	
Top of slab			4.99	142.40	Top of conc. slab
Test pipe			4.99+7.13 12.12	132.27	Inv. test pipe

Use for final inv. of test pipe

3-18-58
0:00 Dye added
0:02 Water Added
Nothing

3-25-58
0:00 Dye
0:02 Water
0:07½ Trace
0:09 Very definite

See pg. 7

Arroyo and Vallejo

Date	Reading	H_2O Depth	H_2O Elev.	Weather	Height Above Invert
3-7-58	—	**2.54	136.76	Dry	2.90
3-12-58	4.62	**2.48	136.70	Dry	2.84
3-13-58	4.75	**2.45	136.67	Dry	2.81

Date	Top of Slab (H.I.)	Reading (F.S.)	H_2O Elev.	Time		
3-20-58	142.40	5.79	136.41		0.05"Rain	2.55
3-21-58		2.21	140.19			6.33
3-24-58		2.95	139.45	3:07		5.59
3-25-58		2.95	139.45			5.59
3-31-58		3.65	138.75			4.89
4-11-58		4.53	137.87			4.01
4-17-58		4.95	137.45			3.59
4-21-58		5.85	136.55			2.69
4-28-58		6.01	136.39			2.53
5-5-58		6.10	136.30			2.44
5-9-58		6.10	136.30			2.44
5-20-58		6.11	136.29			2.43
5-26-58		6.11	136.29			2.43
6-4-58		6.12	136.28			2.42
12-26-58		6.11	136.29			2.43
12-29-58		6.07	136.33			2.47
1-2-59		6.05	136.35			2.49
1-6-59		6.05	136.35			2.49
1-9-59		4.40	138.00			4.14

Assumed invert of sewer line 133.86

*See pg. 6

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Arroyo and Vallejo

Date	Top/Slab (H.I.) 142.40	Reading (F.S.)	Gnd. Water Elev.	Height Above Invert	133.86 invert assumed
1-14-59		5.25	137.15	3.29	
1-26-59		6.10	136.30	2.44	
2-2-59		6.10	136.30	2.44	
2-13-59		4.97	137.43	3.57	
2-20-59		2.25	140.15	6.29	
2-27-59		4.80	137.60	3.74	
3-6-59		5.13	137.27	3.51	
3-13-59		6.06	136.34	2.48	
3-20-59		6.08	136.32	2.46	
4-3-59			Unable to Remove plug		

Arroyo and Verde Vista

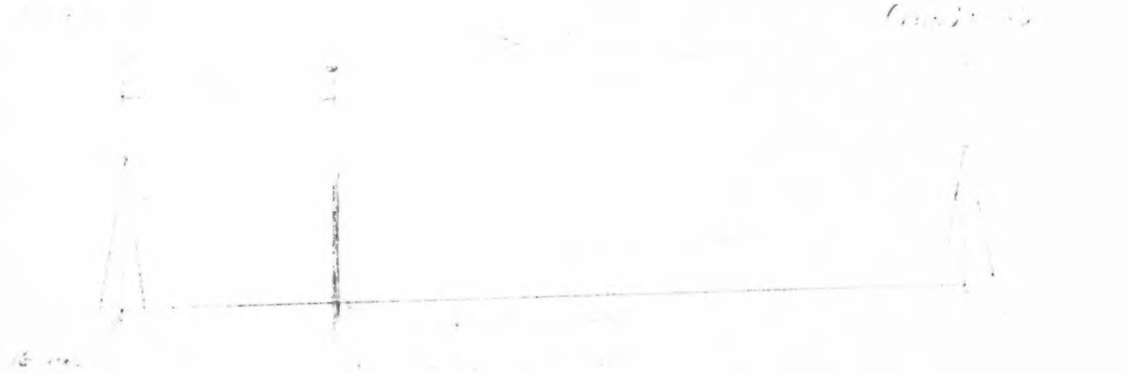
(M.H.)	(B.S.)	(H.I.)	(F.S.)	(Elev.)	
1-92	5.23	155.53		150.30	Rim (Assumed)
			9.53	146.00	E. Inv.
1-99			1.69	153.84	Rim
			5.52	150.01	W. Inv.
**Test Pipe			4.32	151.21	Edge Coupling

Depth of pipe to coupling 4.44 use for first 3 readings pg. 12 (invert 146.77)

3-19-58	5.14	155.44		150.30	Assumed rim
Top of slab			4.10	151.34	Top of slab
Test pipe			4.10+4.48 8.58	146.86	Inv.

Use for final invert of test pipe

3-10-58



3-18-58
0:00 Dye added
0:03 Water "
0:04 Saturated

3-25-58
0:00 Dye
0:01½ Water
0:02½ Saturated

Arroyo and Verde Vista

Date	Reading	H_2O Depth	H_2O Elev.	Weather	Height Above Invert
3-10-58		**0.36	147.13	Dry	*0.05
3-12-58	4.11	**0.33	147.10	Dry	*0.02
3-13-58	4.13	**0.31	147.08	Dry	*0.00

Date	Top of Slab (H.I.) 151.34	Reading (B.S.)	H_2O Elev.	Time			
3-20-58		2.00	149.34		0.05" Rain	2.26	
3-21-58		2.88	148.46			1.38	
3-24-58		3.67	147.67	3:10		0.59	
3-25-58		Missed Reading	—			—	
3-31-58		2.05	149.29			2.21	
4-11-58		3.86	147.48			0.40	
4-17-58		4.00	147.34			0.26	
4-21-58		4.25	147.09			0.01	
4-28-58		4.13	147.21			0.13	
5-5-58		4.30	147.94			*0.04	
5-9-58		4.29	147.05			*0.03	
5-20-58		4.27	147.07			*0.01	
5-26-58		4.26	147.08			*0.00	
6-4-58		4.25	147.09			*0.01	
12-29-58		4.20	147.14			*0.07	
1-2-59		4.15	147.19			0.11	
1-6-59		4.08	147.26			0.18	
1-9-59		3.75	147.59			0.51	Assumed invert of sewer line 147.08

*See pg. 11

**Readings below 147.13 not reliable

Arroyo and Verde Vista

Date	Top/Slab (H.T.)	Reading (F.S.)	Gnd. Water Elev.	Height Above Invert
	151.34			
1-14-59		4.20	147.14	0.06
1-26-59		4.25	147.09	0.01
2-2-59		4.24	147.10	0.02
2-13-59		3.98	147.36	0.28
2-20-59		3.65	147.69	0.61
2-27-59		4.06	147.28	0.20
3-6-59		4.22	147.12	.04
3-13-59		4.15	147.19	.06
4-3-59		4.25	147.09	.01
4-10-59		4.25	147.09	.01
4-17-59		4.23	147.11	.03
1-15-60		4.15	147.19	.11
1-21-60		3.44	147.90	.82
1-26-60		3.67	147.67	.59
1-27-60		3.94	147.40	.32
1-28-60		3.82	147.52	.44
1-29-60		4.00	147.34	.26
2-1-60		3.95	147.39	.31
2-2-60		3.20	148.14	1.06
2-3-60		3.17	148.17	1.09

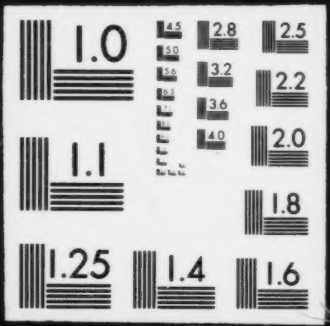
*Readings below 147.13 not reliable

Invert assumed 147.08

3 OF 5

PB

216237


1.0
4.5
5.0
5.6
6.3
2.8
3.2
3.6
4.0
2.5
2.2
2.0
1.1
1.8
1.25
1.4
1.6

Arroyo and Verde Vista

Date	Top/Slab (H.I.)	Reading (F.S.)	Gnd. Water Elev.	Height Above Invert	Invert 147.08 Assumed
	151.34				
2-8-60		3.62	147.72	0.64	
2-9-60		3.61	147.73	.65	
2-26-60		4.10	147.24	.16	
3-8-60		3.10	148.24	1.16	
3-10-60		3.80	147.54	.46	

Readings below 147.13 not reliable

Bay Street - North of Oak

(M.H.)	(B.S.)	(H.I.)	(F.S.)	(Elev.)	Assumed
2-58	3.92	99.62		95.70	Rim
			12.15	87.47	S. inv.
2-57			5.92	93.70	Rim
			14.27	85.35	N. Inv.
**Test pipe			4.81	94.81	Edge coupling

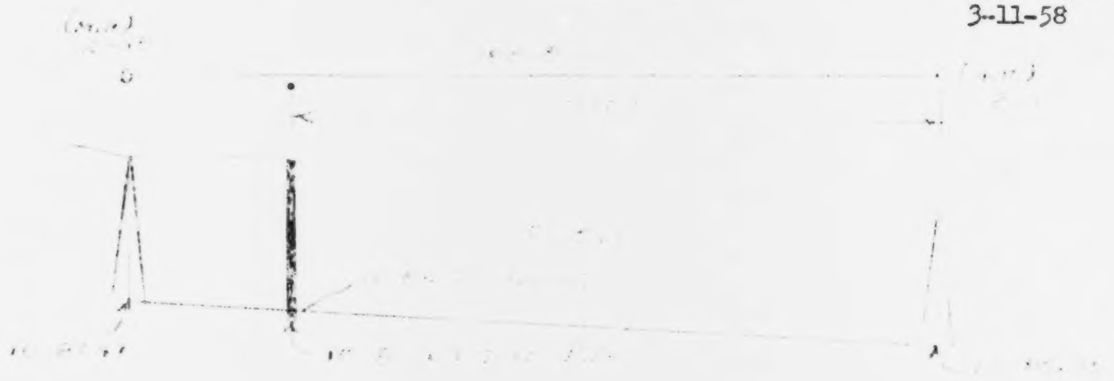
Depth of pipe to coupling 8.19 use for first 3 readings pg. 18 (invert 86.62)

3-19-58

2-58	4.58	100.28		95.70	Rim
Top of slab			5.41	94.87	Top of slab
Test pipe			5.41+8.23 13.64	86.64	Inv.

Use for final invert of test pipe

3-11-58



3-18-58
0:00 Dye added
0:02½ water added
0:13 Trace

0:00 Dye added
0:03 Water added
0:16 Trace
0:19 Cont. trace
500 gal. water used

3-25-58
0:00 dye
0:01½ Water
0:05 Trace
0:07 Cont. trace

Bay Street North of Oak

Date	Reading	H_2O Depth	H_2O Elev.	Weather	Height Above Invert
3-11-58		**2.80	89.42	Dry	2.47
3-22-58	5.67	**2.52	89.14	Dry	2.19
3-13-58	5.95	**2.24	88.86	Dry	1.91

Date	Top of Slab (H.I.) 94.87	Reading (F.S.)	H_2O Elev.	Time		
3-20-58		6.42	88.45		0.05" rain	1.50
3-21-58		3.21	91.46			4.51
3-24-58		2.02	92.85	3:22		5.90
3-25-58		2.06	92.81			5.86
3-31-58		2.45	92.42			5.47
4-11-58		2.87	92.00			5.05
4-17-58		5.15	89.72			2.77
4-21-58		6.05	88.82			1.87
4-28-58		7.10	87.77			0.82
5-5-58		7.60	87.27			0.32
5-9-58		7.78	87.09			0.14
5-20-58		7.90	86.97			0.02
5-26-58		7.85	87.02			0.07
6-4-58		7.84	87.03			0.08
12-26-58		7.80	87.07			0.12
12-29-58		7.80	87.07			0.12
1-2-59		Not made				
1-6-59		7.80	87.07	**See pg. 17		0.12

IG of Sewer
86.95

Bay St. north of Oak

Date	Top/Slab (H.I.)	Reading (F.S.)	Gnd. Water Elev.	Height Above Invert	
	94.87				86.95 Invert
1-9-59		7.76	87.11	0.16	
1-14-59		7.85	87.02	0.07	
1-26-59		7.77	87.10	0.15	
2-2-59		7.80	87.07	0.12	
2-13-59		7.90	86.97	0.02	
2-20-59		2.12	92.75	5.80	
2-27-59		4.40	90.47	3.52	
3-6-59		6.12	88.75	1.80	
3-13-59		7.18	87.69	0.74	
3-20-59		7.67	87.20	0.25	
4-3-59		7.70	87.17	0.22	
4-10-59		7.70	87.17	0.22	
4-17-59		7.75	87.12	0.17	
4-27-59		7.78	87.09	0.14	

Bay Street north of Laurel

(M.H.)	(B.S.)	(H.I.)	(F.S.)	(Elev.)	Assumed
2-52	4.70	103.30		98.60	Rim
			10.67	92.63	S. Inv.
2-47			4.23	99.07	Rim
			12.12	91.18	N. Inv.
**Test pipe			4.83	98.47	Edge coupling

Depth of pipe to coupling 7.09

Use for first 3 readings pg. 24 (invert 91.38)

3-19-58

2-52	4.34	102.94		98.60	Rim
Top of slab			4.45	98.49	
Test pipe			4.45+7.14 11.59	91.35	Inv.

Use for final invert of test pipe

3-11-58

3-17-58
0:00 Dye added
0:06 Water "
0:19 Trace
0:22 Increased trace
0:25 Saturated

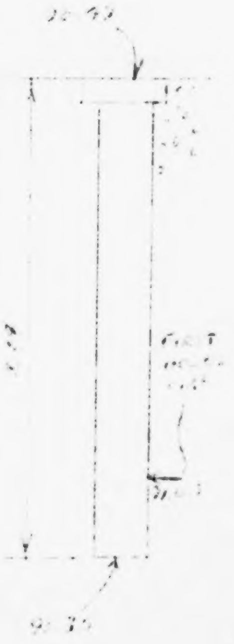
3-18-58
0:00 Dye added
0:06½ Water added
0:13 saturated

3-25-58
0:00 Dye
0:02½ Water
0:05½ Trace
0:06 saturated

Bay St. north of Laurel

Date	Reading	H_2O Depth	H_2O Elev.	Weather	Height Above Invert
3-11-58		**0.93	92.31	Dry	0.07
3-12-58	5.13	**1.96	93.34	Dry	0.10
3-13-58	5.17	**1.92	93.30	Dry	0.06

Date	Top of Slab (H.I.) 98.49	Reading (F.S.)	H_2O Elev.	Time		
3-20-58		5.74	92.75		0.05" rain	0.51
3-21-58		5.35	93.14			0.90
3-24-58		4.90	93.59	3:20		1.35
3-25-58		4.60	93.89			1.65
3-31-58		4.60	93.89			1.65
4-11-58		4.70	93.79			1.55
4-17-58		5.40	93.09			0.85
4-21-58		5.63	92.86			0.62
4-28-58		6.01	92.48			0.24
5-5-58		6.10	92.39			0.15
5-9-58		6.15	92.34			0.10
5-20-58		6.32	92.17			- 0.07
5-26-58		6.38	92.11			- 0.13
6-4-58		6.65	91.84			- 0.40
12-26-58		6.70	91.79			
12-29-58		6.70	91.79			
1-2-59		6.80	91.69			
1-6-59		6.61	91.88			
1-9-59		6.62	91.87			



Assumed
Inv. of Sewer
92.24

**See pg. 23

Bay St. north of Laurel

Date	Top/Slab (H.I.)	Reading (F.S.)	Gnd. Water Elev.	Height Above Invert
	98.49			
1-14-59		6.65	91.84	
1-26-59		6.65	91.84	
2-2-59		6.60	91.89	
2-13-59		6.02	92.47	0.23
2-20-59		5.00	93.49	1.25
2-27-59		5.45	93.04	0.80
3-6-59		5.90	92.59	0.35
3-13-59		6.02	92.47	0.23
3-20-59		6.05	92.44	0.20
4-3-59		6.10	92.39	0.15
4-10-59		6.28	92.21	- .03
4-17-59		6.53	91.96	- .28
1-26-60		6.32	92.17	
1-27-60		6.33	92.16	
1-29-60		6.30	92.19	
2-1-60		6.42	92.07	
2-9-60		5.67	92.82	0.58
3-8-60		5.75	92.74	0.50

5G-29

Cherry Ave. between Clayton & Railroad

(M.H.)	(B.S.)	(H.I.)	(F.S.)	(Elev.)		
2-21	2.51	115.71		113.20	Assumed	Rim
			8.61	107.10		E. Inv.
2-20			5.01	110.70		Rim
			11.28	104.43		W. Inv.
**Test pipe			4.43	111.28		Edge Coupling

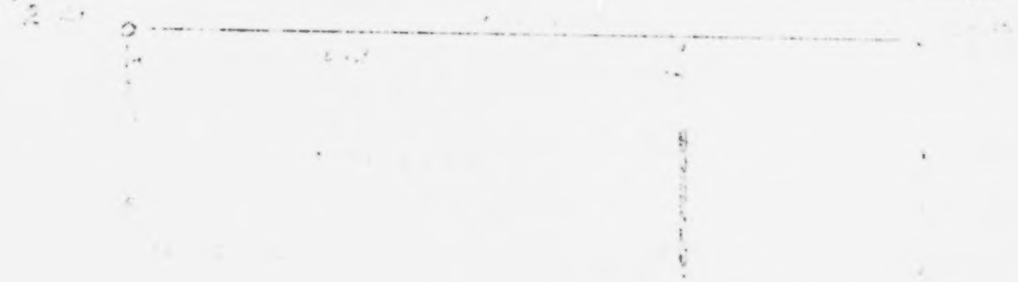
Depth of pipe to coupling 6.91 - use for first 3 readings pg. 30 (invert 104.37)

3-19-58

2-20	4.02	114.72		110.70	Rim
Top of slab			3.35	111.37	
Test pipe			3.35+6.94 10.29	104.43	Inv.

Use for final invert of test pipe

3-11-58



3-18-58
0:00 Dye added
0:03 Water added
0:20 trace

3-25-58
0:00 Dye
0:02 Water
0:04 Trace
0:09 Cont. trace

Cherry

Date	Reading	H_2O Depth	H_2O Elev.		Weather	Height Above Invert
3-11-58		**2.11	106.48		Dry	1.44
3-22-58	4.58	**2.33	106.70		Dry	1.66
3-13-58	4.66	**2.25	106.62		Dry	1.58

Date	Top of Slab (H.I.) 111.37	Reading (F.S.)	H_2O Elev.	Time		
3-20-58		3.27	108.10		0.05"	3.06
3-21-58		3.21	108.16			3.12
3-24-58		3.15	108.22	3:15		3.18
3-25-58		2.38	108.99			3.95
3-31-58		3.02	108.35			3.31
4-11-58		3.40	107.97			2.93
4-17-58		4.00	107.37			2.33
4-21-58		4.38	106.99			1.95
4-28-58		5.15	106.22			1.18
5-5-58		5.67	105.70			0.66
5-9-58		5.93	105.44			0.40
5-20-58		6.21	105.16			0.12
5-26-58		6.22	105.15			0.11
6-4-58		6.21	105.16			0.12
12-26-58		6.26	105.11			0.07
12-29-58		6.25	105.12			0.08
1-2-59		6.18	105.19			0.15
1-6-59		4.20	107.17			2.13
1-9-59		5.95	105.42			0.38

Assumed invert
of sewer
105.04

**See pg. 29

5G-31

Cherry Ave.

105.04 Invert

Date	Top/Slab (H.I.) 111.37	Reading (F.I.)	Gnd. Water Elev.	Height Above Invert
1-14-59		5.65	105.72	0.68
1-26-59		5.60	105.77	0.73
2-2-59		5.85	105.52	0.48
2-13-59		5.02	106.35	1.31
2-20-59		3.75	107.62	2.58
2-27-59		4.25	107.12	2.08
3-6-59		4.80	106.57	1.53
3-13-59		5.38	105.99	0.46
3-29-59		5.87	105.50	0.28
4-3-59		6.05	105.32	
4-10-59		6.20	105.17	0.13
4-17-59		6.15	105.22	0.18
4-27-59		6.15	105.22	0.18

Cecelia inters. of Marty

(M.H.)	(B.S.)	(H.I.)	(F.S.)	(Elev.)	
3-2	4.28	185.98		181.70 Assumed	Rim
			10.97	175.01	W. Inv.
**Test pipe			3.79	182.19	

Depth of pipe to coupling 7.18

Use for first 3 readings pg. 36 (invert 175.01)

3-19-58

3-2	5.08	186.78		181.70	Rim
Top of slab			4.56	182.22	
Test pipe			4.56+7.20 11.76	175.02	Inv.

Use for final invert of test pipe

3-10-58

3-18-58
0:00 Dye added
0:02 Water
Nothing

3-25-58
0:00 Dye
0:01 Water
0:26 Nothing

Cecelia

Date	Reading	H_2O Depth	H_2O Elev.	Weather	Height Above Invert
3-10-58		1.05	176.06	Dry	0.72
3-12-58	6.07	1.11	176.12	Dry	0.78
3-13-58	7.17	1.01	176.02	Dry	0.68

Date	Top of Slab	Reading	H_2O Elev.		
	182.22				
3-20-58		6.24	175.98	0.05" rain	0.64
3-21-58		6.06	176.14		0.80
3-24-58		6.22	176.00(3:43)		0.66
3-25-58		6.28	175.94		0.60
3-31-58		Buried	——		——
4-11-58		"	——		——
4-17-58		6.50	175.72		0.38
4-21-58		6.60	175.62		0.28
4-28-58		6.65	175.57		0.23
5-5-58		6.70	175.52		0.18
5-9-58		6.75	175.47		0.13
5-20-58		6.85	175.37		0.03
5-26-58		6.86	175.36		0.02
6-4-58		6.90	175.32		- 0.02

Assumed invert
of sewer
175.34

5G-37

Ward, Reichert
Doss, Kafka

Cecelia Dr. Hydrostatic Test

April 15, 1966 clear temperature 60± time 9:59 a.m. equipment at site and ready. 1000 gal. H_2O in tank truck. Diff. in invert elevation between MH3-1, MH92B 5.31' Line is V.C. 6" dia. and a mortar joint length of line 501.6' (M.H. 3-1 to M.H. 93E) Time test start 10:03 stop 10:12 elapsed 12 min. Type material around pipe. Do not know. Moisture content, damp. Trench backfill do not know. Pipe bedding is considered in damp condition. Line was not cleaned prior to testing. M.H. vol. section used below taper section dia. 48 H. in 0.1'. Then converted for vol. to inch.

Min.	H drop in ft.
(1) 3:47	0.5'
(2) 3:44	0.6'
(3) 5:11	0.7'
(4) 6:04	0.8'
(5) 6:58	0.9'

Max. allowable = .00592x501.6x2x24=142 gals day

Theoretical = $\frac{7.6\times10^6\times47.01}{.6\times501\times3.889}$ = 30,700 gpd

gpd per in. dia. pipe per mile Avg. 268,000

Actual in field per day

(1) $\frac{47.0 \text{ gals}}{3.78 \text{ time}}$ = 12.43 gal/min., 12.43 gpmx1440 = = 17,910 gpd

(2) 17,150 gpd

(3) 18,288 gpd

(4) 17,857 gpd

(5) 17,568 gpd

Avg. = 17,750 gpd

Actual PD

Max. allowable 142.0 gpd

April 15, 1966 Hydrostatic Test

M.H. 3-1 ½" drop in 12 min. or 19.830 gals hr. or 475.9 GPD leakage

---

Hydrostatic test MH92E

Good test no measureable drop after 20 min. M.H. rim opening Used for vol.

CECELIA DR. TO MARTY DR.

Hydrostatic Test

MH 92 E to MH 3-2 test No. I est. 60°F. Time 13:30 April 15, 1966. Diff. in invert 2.54' Description of pipe used V.C. 6" dia. Mortar type joint. Length of line 299'. Line was not cleaned before testing. Time test start 13:40 Stop 13:58 elapsed 18 min. Material around pipe - do not know. Moisture content. Damp. Trench backfill - do not know. Moisture content damp. Pipe bedding is considered to be in a damp condition.

Vol. used for calculation
all readings below taper section

Time	Drop
(1) .22'	0.1'
(2) 1.11'	0.2'
(3) 2.16'	0.3'
(4) 3.38'	0.4'
(5) 1.08	0.1

Max. allowable

.00592x299x2x24 = 84.96 GPD

Actual in field

(1) 7.8337x1.2' = 9.4 gal, 914 ÷ 365 = 25.756 GP Min.

(2) 37,080 GPD

(3) 17,870 GPD

(4) 20,793.1 GPD

(5) 16,315 GPD Avg. 22,900 GPD

Theoretical for GPD per inch dia. pipe per mile

(1) $\frac{7.6\text{x}10^6\text{x}7{,}833}{6\text{x}299\text{x}.366}$ = 90,465 GPD per inch dia. per mile

Avg. 51,000 GPD per inch dia. pipe per mile

Hydrostatic Test MH 3-2

Vol used Rim to taper

Section

Time	Drop ft.
(1) 3:11	.05
(2) 5:50	.10

1.9584x1.18=2.31 gals.

2.31 ÷ 5.833 = .396 gal. per min.

570.24 GPD

5G-38A

Hydrostatic test 92-D

No visible or measurable drop in 24 min. very good MH

CECELIA DR.

Hydrostatic test.

MH3-2 to MH92-D Temp. 60±

Clear diff. in invert elevation 5.25 ft. Description VC pipe 6" dia. mortar joints. Length 247.1 ft. Line 247.1 ft. Time start 10:08 stop 10:15 elapsed 7 min. Type material do not know. Moisture content damp. Pipe bedding is considered to be in a damp condition.

Time	Feet
1. .18	0.1'
2. .38	0.38'
3. 47.5	0.4'
4. 1.01	0.5'
5. 1.18	0.6'
6. 1.31	0.7'
7. 1.47	0.8'
8. 1.59	0.9'

Taper section all measurements below this section in st. barrel

Theoretical for 1 mile per inch dia. pipe GPD

(1) $\frac{7.6\text{x}10^6\text{x}9.20}{6\text{x}247.1\text{x}.30}$ = 160,500 GPD per inch diam. pipe per mile

(2) $\frac{7.6\text{x}10^6\text{x}27.6}{6\text{x}247.1\text{x}1.33}$ = 229,000 GPD

243,000 GPD

239,000 GPD per inch dia. per day per mile

222,000 GPD

(1) 7.8337x1.2 = 9.4, 9.4 /.366 = 25.86 GP min.

37,238 GPD

(2) 42,998 GPD (3) 81,360 GPD

(4) 59,8896 GPD (5) 62,467 GPD

Avg. 56,700 GP Day

Max. allowable 247.1x.00592x2x24 = 70.21 GPD

Marty north of Lorna Drive

(M.H.)	(B.S.)	(H.I.)	(F.S.)	(Elev.)		
3-3	5.51	188.51		183.00	Assumed	Rim
			11.27	177.24		N. Inv.
**Test pipe			4.71	183.30		

**Depth of pipe to coupling 4.59

Use for first 3 readings pg. 42 (invert 179.21)

3-19-58

3-3	5.10	188.10		183.00	Assumed	Rim
Top of slab			4.19	183.91		
Test pipe			4.19+4.60 8.79	179.31		Inv.

Use for final invert of test pipe

3-10-58

3-18-58
0:00 Dye added
0:02 Water added
nothing appeared

3-25-58
0:00 Dye
0:01 Water
0:18 Trace

Date	Reading	H_2O Depth	H_2O Elev.	Weather	Height Above Invert
3-10-58		**	Dry	Dry	0.00
3-12-58		**	Dry	Dry	0.00
3-13-58		**	Dry	Dry	0.00

Date	Top of Slab (H.I.) 183.91	Reading (F.S.)	H_2O Elev.		
3-20-58		2.86	181.05	0.05" Rain	2.76
3-21-58		4.45	179.46		*1.17
3-24-58		4.43	179.48 (3:45)		*1.19
3-25-58		4.46	179.45		* 1.16
3-31-58		4.25	179.66		1.37
4-11-58		4.35	179.56		1.27
4-17-58		4.55	179.36		*1.07
4-21-58		4.55	179.36		*1.07
4-28-58		4.53	179.38		*1.09
5-5-58		4.55	179.36		*1.07
5-9-58		4.50	179.41		*1.12
5-20-58		4.50	179.41		*1.12
5-26-58		4.50	179.41		*1.12
6-4-58		4.46	179.45		*1.16
12-26-58		4.51	179.40		*1.11
12-29-58		4.54	179.37		*1.08
1-2-59		4.50	179.41		*1.12
1-6-59		4.45	179.45		*1.17
1-9-59		4.45	179.45		*1.17

*Any reading below elev. 179.49 not reliable

Assumed IG of pipe 178.29

5G-43

Marty

Date	Top/Slab (H.I.)	Reading (F.S.)	Grnd. Water Elev.	Height Above Invert	178.29 invert
	183.91				
1-14-59		4.48	179.43	*1.14	
1-26-59		4.55	179.36		
2-2-59		4.50	179.41		
2-13-59		4.47	179.44	*1.15	
2-20-59		4.50	179.41	*1.12	
2-27-59		4.50	179.41	*1.12	
3-6-59		4.48	179.43	*1.14	
3-13-59		4.44	179.47	*1.18	
3-20-59		4.43	179.48	*1.19	
4-3-59		4.45	179.46	*1.17	
4-10-59		4.50	179.41	*1.17	
4-17-59		4.45	179.46	*1.17	

*Readings below 149.49 not reliable

Davidson St.-Layout for Testing sealing of leaking pipes by subsurface application of asphalt

Sta.	BS	H.I.	F.S.	Elev.	I.G.	Depth	
MH 13	11.11	116.39		105.28			Inv. at W. edge rim M.H. 13
0+00			5.48	110.91	105.28	5.63	
0+05			5.42	110.97	105.29	5.68	
+10			5.51	110.88	105.31	5.57	
+15			5.52	110.87	105.33	5.54	
+20			5.50	110.89	105.34	5.55	
+25			5.50	110.89	105.36	5.53	
+30			5.44	110.95	105.37	5.58	
+35			5.38	111.01	105.39	5.62	
+40			5.32	111.07	105.40	5.67	
+45			5.28	111.11	105.42	5.69	
+50			5.26	111.13	105.43	5.70	
+55			5.24	111.15	105.45	5.70	
+60			5.19	111.20	105.47	5.73	
+65			5.17	111.22	105.48	5.74	
+70			5.15	111.24	105.50	5.74	
+75			5.12	111.27	105.51	5.76	
+80			5.11	111.28	105.53	5.75	
+85			5.08	111.31	105.54	5.77	
+90			5.04	111.35	105.56	5.79	
+95			5.00	111.28	105.57	5.71	
1+00			4.95	111.44	105.59	5.85	
1+05			4.89	111.50	105.61	5.89	

Sta.	B.S.	H.I.	F.S.	Elev.	I.G.	Depth	
1±10		116.39	4.82	111.57	105.62	5.95	
1+15			4.77	111.62	105.64	5.98	
1+20			4.71	111.68	105.65	6.03	
1+25			4.64	111.75	105.67	6.08	
1+30			4.58	111.81	105.68	6.13	
1+35			4.50	111.89	105.70	6.19	
1+40			4.43	111.96	105.71	6.25	
1+45			4.36	112.03	105.73	6.30	
1+50			4.29	112.10	105.74	6.36	
1+55			4.22	112.17	105.76	6.41	
1+60			4.15	112.24	105.78	6.46	
1±65			4.08	112.31	105.79	6.52	
1+70			4.03	112.36	105.81	6.55	
1+75			3.97	112.42	105.82	6.60	
1+80			3.88	112.51	105.84	6.67	
1+85			3.83	112.56	105.85	6.71	
1+90			3.77	112.62	105.87	6.75	
1+95			3.71	112.68	105.88	6.80	
2+00			3.66	112.73	105.90	6.83	
2+05			3.67	112.72	105.92	6.80	
2+10			3.64	112.75	105.93	6.82	
2+15			3.54	112.85	105.95	6.90	
2+20			3.48	112.91	105.96	6.95	
2+25			3.42	112.97	105.98	6.99	
2+29			3.32	113.07	105.99	7.08	M.H. 16 Rim
MH16 Inv.			10.40	105.99			

Trial Application asphalt to soil in Exist. trench on Davidson St. (RS-1)

Prior to application asphalt to subsoil, section of line between M.H. 13 and 16 was water tested for exfiltration (See BK 5E) averaged around 30,000 gal/day/in diam/mi. day on 6/9 and 6/10 So. Pk. crew drove holes with driving tool at 5 pt. intervals on alt. sides of sewer line starting at 2+25 and proceeding to 1+20 (see pg. 51). These holes were driven 12" off centerline to depth of 6" (to pt.) below I.G. of sewer. On morning of 6/11 Rd. Dept. furnished tank truck with 1400 gals. of RS-1. This material was applied with applicator starting first at 2±25 with tool down to bottom of hole. In a short time oil appeared at 2+20. Applicator was moved to 2+15 but oil leaked up past seal on applicator. Applicator was moved to adj. holes, still placed at full depth but oil still leaked past seal. Seal was found to be effective if app. driven only about 3 ft. in ground. (This seemed to be due to fact that driving tool tended to drift to center of trench during last 3 ft. ± of driving. This produced an ellipitcal hole at pt. where seal came to rest when applicator was driven to bottom of hole. Oil was put in each hole along the line in turn, except when oil had appeared in hole from application at previous hole.

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In such cases hole was skipped and applicator placed in next hole. In some of these cases oil would then appear in skipped hole and in other cases in next succeeding hole. In one instance oil by-passed adjacent untreated hole and appeared in next succeeding hole. Only small pinhole flow was noted in by-passed hole. Oil appeared first in holes at depth of about 3-4 feet.

Davidson St. - Experiment with sealing of Exist. sewer pipes w/external subgrade application of hot asphalt

Arrangements made with I.J. Ely Co. of Larkspur to provide heated tank truck w/500 gals. asphalt (as used for sub-sealing pavement.) with equipment and men to place material in pipes previously placed by district forces at chosen locations along Davidson Street. As shown in sketch. 180 air blown asphalt used. Tank was provided with press. gage and temp. gage. Press. gage read 80 psi during test but was 30 psi too high, leaving pressure of 50 psi. Temp. gage read 360-380° F. Truck arrived at 9:50 a.m.

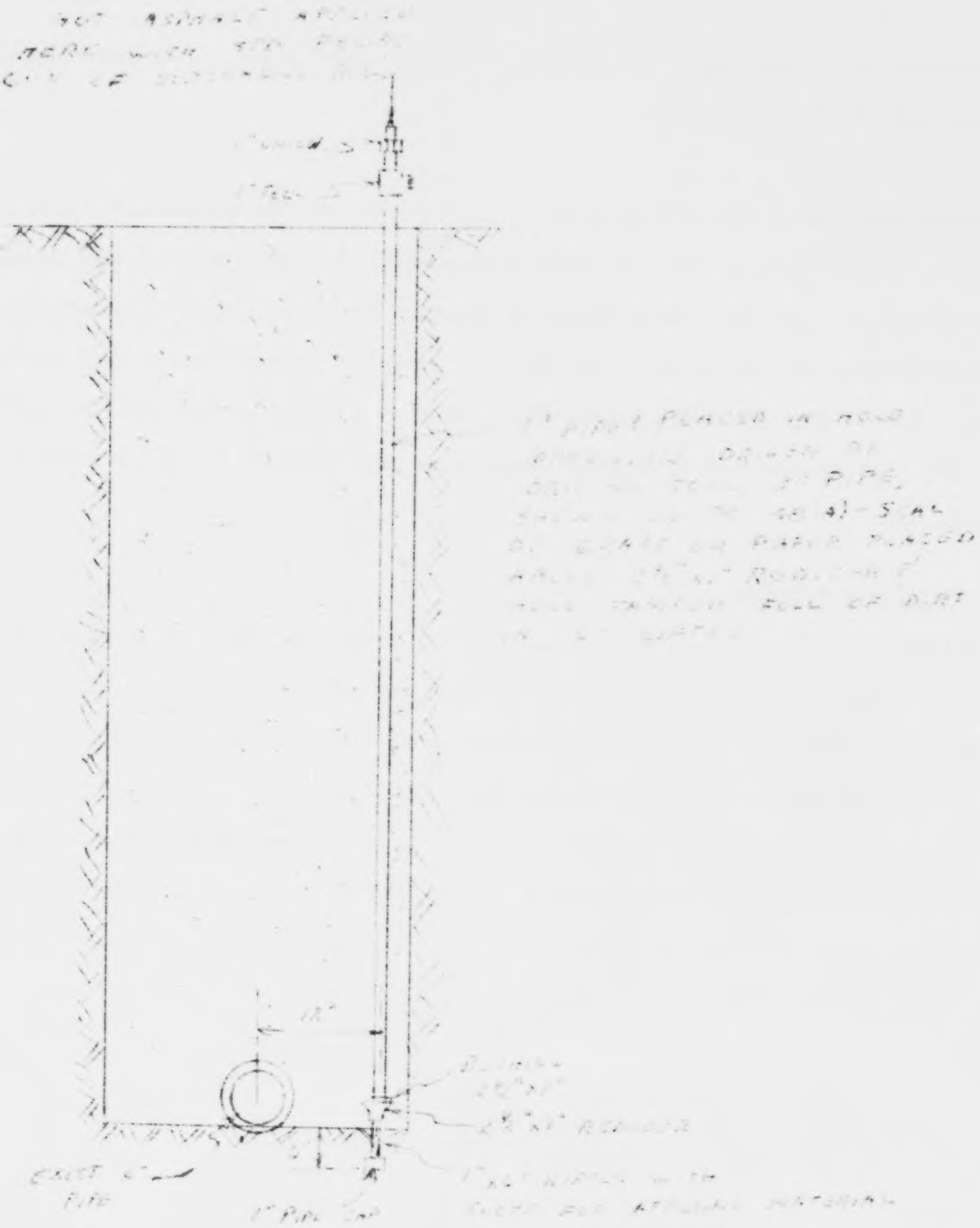
Application Schedule

Oil applied first in hole #1 (see pg. 51) oil never did appear at surface. Press. on for 3 min. 20 sec. approx. 40+ gals. used (by gage stick in tank) after valve shut off, traces of oil emulsion (previously applied on upper stretch of line) appeared in flow in downstream M.H.) Time = 10:57 a.m.

Oil applied next at Hole #2. After 2 min., 56 sec. it appeared in pipe in #4 hole and broke through pavement, around #2 hole. Before rig could be shut off, pavement cracked along no. side of trench from

5G-50A

6-19-58


UNION
1" TEE
1" PIPE PLACED IN HOLE
PIPE,
PLACED
FULL OF DIRT
12"
BUSHING
REDUCER
EXIST 6" PIPE
1" PIPE CAP
FOR MATERIAL

M.H. 16	2+29.1
	2+25
	2+20
	2±15
	2+10
	2+00
	1+95
	1+90
	1+85
	1+80
	1+75
	1+70
	1+65
	1+60
	1+55
	1+50
	1+45
	1+40
	1+35
	1+30
	1+25
	1+20
#1	1+05
#2	1+00
#3	0+95
#4	0+90
#5	0+80
#6	0+70
#7	0+55
#8	0+40
#9	0+20
M.H. 13	0+00

Hole #2 to 7½ ft. est. 35± gals. used. 11:08 a.m.

Oil applied at hole #3 at 11:16 a.m. and appeared in pipe #2 in 2 min., 4 sec. 25± gals. used.

Oil applied at hole #5 at 11:26½ a.m. came through pave. 5 ft. E. of #5 on No. side of trench in 2 min. 35 ± gals. used.

Oil applied in #6 pipe but blew up past pipe seal. 40± gals. used.

Oil applied in #7 pipe at 11:40 a.m. Cracked pave. along No. side of trench in 3 min. 35 sec. before it could be shut off. Crack appeared along so. side of trench.

Prior to treating #8 hole, several blasts of high press. air were given to #8 and #9 hole (11:45 a.m.) Oil then applied to #8 hole. After 2 min. 15 sec. it appeared 4 ft. W. of #8 on No. side of trench. 40 ± gals. used.

About the time oil was shut off #8 hole it began appearing in downstream M.H. Test was then discontinued while crew rodded line out.

Excavation of treated line showed hot asphalt got no farther east than 5 ft. each of #8 tube.

Joint in vicinity of #8 had asphalt formed around a portion of it and bell but did not stick to pipe.

At 6 ft. W. of #4, asphalt had coated over a portion of mortar joint. Joint did not leak until asphalt pealed off. Asphalt did not adhere to mortar, but molded itself around it.

Portions of line in ea. excavation were removed for closer exam. and replaced with V.C. with hot poured jts.

H_2O Test Fifth St. Boyes Springs prior to Exp. with sealing of existing sewer pipes w/external application of RS-1 (emuls. asphalt)

Note: See sketch on pg. 52

Inlet from Fifth St. to M.H. 28 plugged and water added to F.I. 15. Previous to starting test, occupant of hse. connected at 0+74 aggred not to use sewer during time test was conducted. This was only hse. service on sewer (according to record). Line was filled to 6" dn. from road surface and then allowed to leak out. Line was then refilled to starting point and allowed to drop again but remaining head in H_2O tank was not sufficient to provide "Q" to fill line. Joints and holes in M.H. 28 were observed to be leaking badly. Also water added at F.I. 15 (as identified by dye) was observed flowing thru M.H. 28 from Baines Ave. line. Joint in invert of Fifth St. line downstream from plug in entrance to M.H. 28 was observed to be passing dyed water added at F.I. 15 (pictures were taken of these leaks)

6-27-58 - Clear and warm

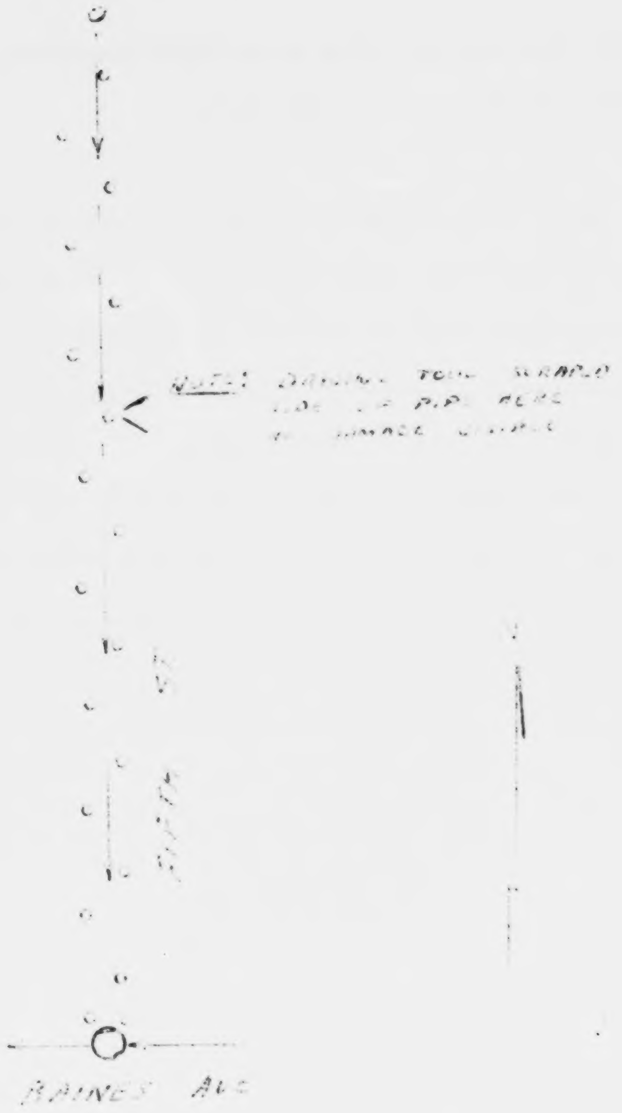
Dist. Dn. to H_2O in Tank Truck	Vol. Above H_2O Surf.	Gals. Used	Time
0.63	81 gals.	----	----
2.08	430	349	0 (Line full)
2.88	643	213	4 min. 5 sec. (Line refilled)

$$I = \frac{7.6 \times 10^6 Q}{D x L x T} = \frac{7.6 \times 10^6 x 213}{6 x 95 x 4.08} = 696{,}000 \text{ gpd/in diam.-mi.}$$

Experiment with Sealing Leaky Sewer Pipes w/external injection of RS-1 on Fifth St. between Baines and Calle del Monte

Method: Holes were punched on alternate sides of the sewer line (approx. 12" off lines located with sewer rod and "M" scope) as shown on sketch. Sketch of tool used to form holes is shown on pg. 28, applicator as shown on pg. 50 was then placed in ea. hole and dirt tamped around it to street surface. County truck containing 1400 gals. RS-1 applied material. Flow was metered through 5/8" "Empire National" water meter scrapped by City of S.R. Pressure to applicator body was controlled by adjusting relief valve on tank truck and valve on assembly used to connect to applicator. Latter valve was used in conjunction with gage graduated from 0-15 psig placed past valve and connected to line with "U" tube filled with H_2O.

F.I. 15	(0+95)
	0+90
	0+85
	0+80
	0+75
	0+70
	0+65
	0+60
	0+55
	0+50
	0+45
	0+40
	0+35
	0+30
	0+25
	0+20
	0+15
	0+7.5
M.H. 28	(0+00)


NOTE: DRAGGING TOOL SCRAPED
SIDE OF PIPE HERE
NO DAMAGE VISIBLE
BAINES AVE

Experiment with sealing leaky sewer pipes w/external injection of RS-1 on Fifth St. between Baines and Calle Del Monte

Application: Injection began Sta. 0+00 at 9:00 a.m. valves each side of point of injection left open to provide air bleed and full flow within trench bottom. When asphalt appeared in sewer stream thru manhole, injection was stopped and applicator moved to next point. Pressure of application varied from less than one psig at some points to 10 psig at other points. At point of beginning, asphalt appeared in stream within 18 seconds. "porcupine" tool on sewer rod was run in sewer pipe to a place past point of application and withdrawn after injection ceased in order to clear all clumps that would form inside of pipe at leak or breaks. Most stations showed leaking of asphalt in pipe, except the following where high pressure and large volumes were used:

Sta. 0+40 (low volume), 0+50 (very low pressure), 0+75, 0+85

A second application at all points was made beginning Sta. 0+00 at 2:15 p.m.

7/9/58

LOG

First Run				Second Run		
Sta.	Time	PSIG	Gal	Time	PSIG	Gal
0+00	18"	4	5	25"+25"	1	5
0+75	——	——	--	3'40"	6	18
0+15	2'54"	7	17	52'54"	10-8	6
0+20	4'33"	3	42	5'25"	1	38
0+25	1'20"	10-5	8	2'35"	9	4
0+30	5' + 7'35"	4	47	1'6"	4	6
0+35		0	15	1'12"	1	8
0+40	7'05"	10-7	11	55"	9	1*
0+45	2'46+5'12"	0	7			
0+50	11'27"	1	104			
0+55	51'+1'34"	0	26	3'09"	10	0**
0+60	——	--	--	1'45"+9'	6-2	28
0+65	1'49"	1	14	2'09"	5	1
0+70	2'00"	8-6	10			
0+75	7'45"	High	47			
0+80	2'12"	10-6	13			
0±85	7'22"	10	58			
0+90	5'40"	8	5			

Note *Injection pipe was full and overflowed when head was removed.

**Pressure was boosted to beyond gauge scale (15#) and held 1½ min. with 0 flow

7-10-58

Fifth St. Water test after subgrade Application RS-1

Note: See pg. 52 for sketch

Fifth St. inlet to M.H. 28 was closed and water added at F.I. 15. Line seemed to fill rapidly and water was turned off when H_2O level reached road surface; however we neglected to start stop watch, which was realized after about 30 sec. So we filled line again. But were unable to fill line for third time to conclude test. So we got another truck of water. C.O. cap was removed on second test to vent line.

7/10/58 - Clear and warm

Dist. dn. to H_2O surf in tank before test = 0.39 ft. = 40 gal.

Line full = 1.55 " = 291

251 gal.

Line full again = 2.07 427

Unable to fill again

Second test

Start test-dist. dn. = 0.43 = 46 gals.

Line full (0 min.) = 2.30 = 490

Line refilled (30 min) = 2.76 = 612

122

$$I = \frac{7.6 \times 10^6 Q}{D x L x T}$$

$$= \frac{7.6x10^6x122}{6x95x3}$$

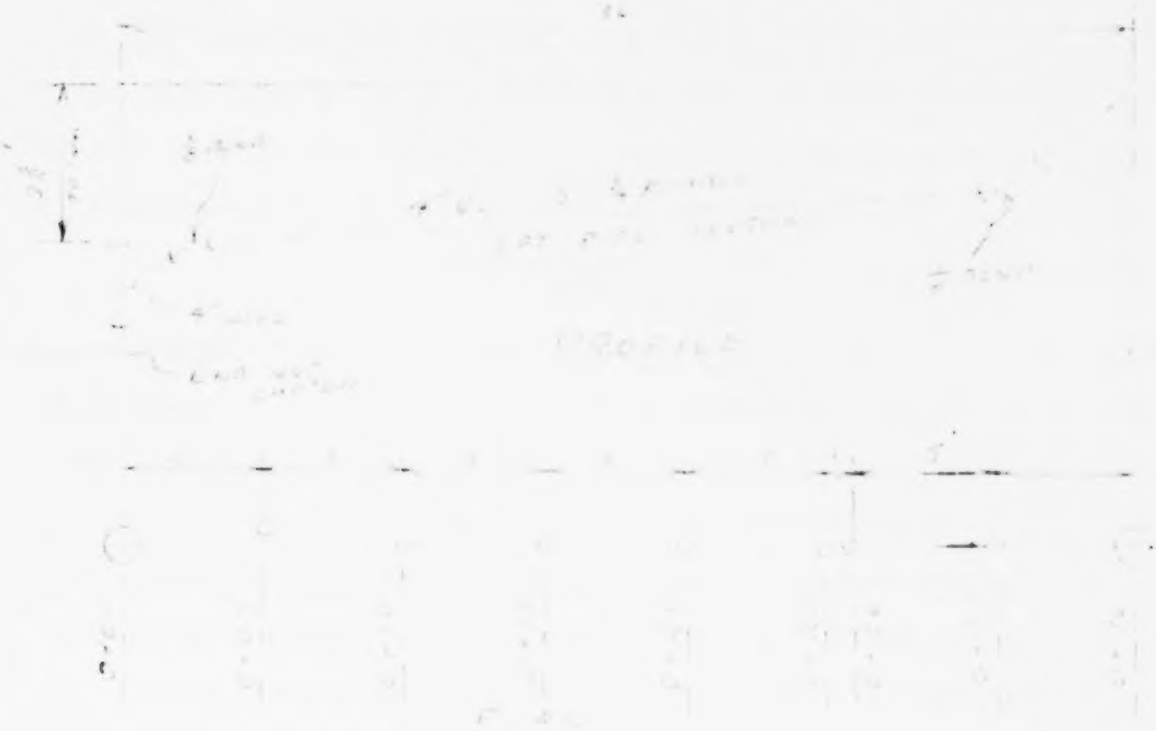
= 543,000 gpd. in. diam.-mi.

Experiment to determine effect of sustained pressure when applying RS-1 underground

Trench was dug by backhoe in undisturbed earth at So. Co. Corp. Yd., Bennett Valley Rd., S.R. 4"dx24" sections B&S V.C. pipe were laid as shown. Bell holes were dug at each bell. All joints were tightly caulked with one (1) strand oakum and weak mortar mix(6 sand to 1 cement). Holes were punched in joints with nail to aid penetration. Pipe was cut and butted together at 0+20. Joints were left to set overnight with no means of curing provided.

7/30/58 - Applicators as salvaged from Fifth St. were placed as shown. All backfill was placed by hand in 8" layers and thoroughly compacted by pneumatic tamper.
50 gal. barrel was placed on stand 5' high and connected by valved manifold to "8+10", 0+15 and 0+20.

7-30-58 5G-57A



Note: Applicators shown thus: "0" were same as shown on pg. 50. One at 0+05 was placed midway between pipe barrel and trench wall with bottom at elev. of pipe inv. other applications were placed directly over pipe with bottom elev. 10" above top of pipe on compacted layer over pipe. "0+05" was placed in hole in compacted backfill. "0+25" "0+26" and "0+31" were set in holes dug 3" in compacted layer.

7/31/58 - Barrel on manifold filled with H_2O but only valve to "0+10" opened. 200 gals H_2O added between 10:00 a.m. and noon. None showed in sump until 1:00 p.m. and then was bailed out as it accumulated. H_2O also showed in 0+05. RS-1 was placed in barrel and valves opened to all three applicators at 2:10 p.m. It appeared on surface at 2:50 p.m. on E side trench at 0+12. Valve at 0+05 turned down to 1/4 turn which stopped leak. 1/3 depth barrel used by 4:15 p.m.

8/1/58 - Barrel 1/3 (depth) full at 8:00 a.m. RS-1 in "0+26", 8" from ground surf. opened valve on "0+10" completely but it broke through ground at 10:15 a.m. on W. side of trench at "0+12" valve turned back to 1/2 turn which stopped leak. Dug down (1 ft.) along side E. side "0+26" and found asphalt well distributed between compacted particles of soil. Did not backfill hole. Ran rod down 4" V. C. but found no asphalt. Poured 5 gals. H_2O down line at 10:00 a.m. Slow coming thru to sump put new barrel on line at 2:00 p.m. 35 gals. used from old barrel.

8/4/58 - Barrel empty at 9:30 p.m. considerable material had come to surface between hole at "0+26" and Sta."0+20" and possibly thru hold at "0+26" as hole was full. Refilled barrel and placed on line at 11:40 a.m. opened all valves but RS-1 appeared shortly on W side trench at "0+12 and on E side trench at "0+23" at old breaks. Closed valves on "0+10" and "0+20" to 1/2 turn and stopped leaks. Left site at 2:30 p.m. Checked again at 5:00 p.m. found that level in barrel had had no noticeable drop. Left valves in same position for night.

8/5/58 - 8:00 a.m. no material used since 5:00 p.m. last night. Opened all valves but broke thru ground at same spots as previously in very short time. Secured all valves at 8:30 a.m.

5G-66A

Martin St. Hydrostatic Test

4/28/66 08:00 60° F - Clear

Diff. in invert 5.45

Type pipe used V.C. 6" dia. mortar joint.

Length of line 297'. Method of cleaning brushed. Time test start 8:15

Stop 8:55. Elapsed 40 min.

Material around pipe unknown.

Material trench backfill unknown. Moisture content damp. Pipe bedding is considered to be in a damp condition. To fill line 1.47x297 = 438 gal.

To fill MH 2 ft. 2417.832 = 188 gal.

Total 626 gals.

	T	L	
1	1.25	0.1	Max allowable
2	41	0.1	.00592x297x2x2.4 = 84.5 gals
3	1.04	0.2	
4	1.35	0.3	Actual
5	2.01	0.4	1x2"x7.8337 = 9.4 gals 9.4/.458
6	2.24	0.5	
7	2.44	0.6	22.8x1440 = 32,200 g/day

Bad line

Theoretical per mile, inch, dia.

Max. allowable 1500 gals, day

Calculated 7,040.5 gals, day

$\frac{7.6x10^6x9.4 \text{ gals}}{6\ x297x41/60}$ = 58,700 GPDP Mile

5G-68

MARTIN ST. SOIL ANALYSIS

4-29-66

Method Sampling - Split
Barrel

Sample A

18"	12"	39/6",25/12,30/18	0"
18"		19/6, 28/12, 36/18	1^6
18"		26/6, 29/12, 38/18	3^0

1 1+Brn. Sa. Gravel
2. with clay
3 Brn. sandy clay
field observation only

Sample A centerline pipe

" B 4' south centerline pipe

Sample B

18"	12	95/6, 124/12, 115/18	0	0^0
18"		43/6, 48/12, 96/18		1^5
18"		38/16, 80/12, 69/18		3^0

o Brn. sandy gravel with clay
1
2 Brn. sandy clay moist firm
3
4

Line Sealing

D. E. Bean's Notes - 8/12/58

Investigate asphalt test with Gene Dykes before meeting. Decided to try 35 gallons of SC-1 in drum on 0+05. Turned valve on at 2:00 p.m. At 4:00 p.m. level in barrel was dropping about a quarter inch every 15 minutes. Work was done at the corporation yard.

8/13/58 9:00 a.m. SC-1 barrel empty. Asphalt had appeared around vitrified clay riser at 0+00. Had Camozzi dig down from 0+00 to 0+08. Lots of asphalt from 0+00 to 0+05. Penetration better in dry soil than in wet. Wet seemed to absorb only in fissures. Less asphalt from 0+05 to 0+08. Ground wetter. Penetration around pipe fair. Appears more material needed in trench and perhaps longer time to soak in. Placed 50 gallon barrel full on line at 0+31 at 5:00 p.m. Flow rapid. Shut valve to 1½ to 2 turns.

8/14/58 - D.E. Bean's Notes - 50 gallon barrel half full. Flow seems to have stopped. Cleaned out line, flow OK. Barrel empty 10:00 a.m. Called Waltenspiel of Windsor Fuel, said they might have MC-1 but no RC-1. Suggested Shell Oil, Santa Rosa, Mahoney. Checked with him will try to arrange pick up at refinery, will call. Mahoney sent representative, Meacham, to see Dykes. They will furnish us free samples in 50 gallon barrels of RC-1, MC-1 also 180 air blown which is cut with special solvent. We pick up in San Leandro. Viscosity of RC-1, MC-1 all same. New barrel SC-1 on line at 12:15 p.m. Empty at 1:25 p.m. New barrel on line at 2:15 p.m. Empty at 3:30 p.m. First asphalt from last test showed in pipe at 0+00 at 2:50 p.m. Removed approximately 2 gallons, approximately 1 gallon had been removed from 0+00 test during the afternoon from this test. New barrel connected at 4:30 p.m. but not turned on.

8/15/58 - Opened valve on new barrel at 9:10 p.m. Before doing this removed 2± gallons from sump. Took barrel off line at 11:10 a.m. approximately 10 gallons left in. New barrel on at 11:48 a.m. One gallon removed from sump during morning til noon. Three-quarters gallon removed at 12:28 p.m.

1/2 gallon removed at 12:35 a.m.

3/4 gallon removed at 1:00 p.m.

1 gallon removed at 1:25 p.m.

Barrel empty at 1:30 p.m. Three quarter gallon removed at 1:55 p.m. New barrel on line 2:00 p.m. One and one-quarter gallon removed at 2:30 p.m. Half gallon removed at 2:45 p.m., three-quarter gallon removed at 3:20 p.m. Time for barrel at 0+31, Number 1, equals no reading. Number two equals one hour ten minutes. Number three equals one hour 15 minutes. Number four equals two hours, 0 minutes. Number four equals one hour 22 minutes. Number six equals one hour forty-five minutes. Barrel empty at 3:45 p.m. Three-quarter gallon removed at 3:45 p.m. Gene and Wallace out at 4:15 p.m. Agreed to dig up trench Wednesday. After digging will flood each excavation with water independently to determine infiltration. Tripp will check with Heitz some time Monday for five gallon paint cans. Will test sample of local dirt and Fifth Street in identical manner. With each type soil and each type asphalt run one test with dry soil and one with wet to test penetration of asphalt. After this test retest with water to determine penetration time of water. In each case have control consisting of identical soil types and moisture content to determine time required to pass water.

8/18/58 - Told Tripp to have man get soil from Fifth Street this afternoon or tomorrow. Tripp will check with Heitz about 5 gallon buckets - 12 required. Will get 8 from Klemmick. Poore and Walt left for Oakland at 8 o'clock to get asphalt.

8/20/58 - Went to corporation yard to work on asphalt test. Camozzi turned dirt on truck bed to equalize water. Will dig up SC-1 test at 1 p.m. One inch of SC-1 left in quart can in bucket. SC-1 test refilled. Camozzi burned out more buckets. Drew sample from each of RC-1, MC-1 and air blown asphalt in 50 gallon drums. Placed sample from each in three can lids. Placed adobe samples in each can lid and in each can. Opened adobe clod, put in SC-1 about 10 days ago. Clod was firm and moist when placed in SC-1 and still was when taken out. SC-1 had penetrated all fine passageways and tracks in sample but did not completely saturate clod. Dug down from 0+31 to end of trench around 4 inch riser to 14 inches ± above pipe. Material found well distributed from 12 inches below ground surface on small hole dug at 0+32 to 10 inches over pipe and water dumped in. Disappeared immediately as though through gravel. Same test tried at 0+21 in soil containing only RS-1 (set). Hardly any absorption noted over long period of time. Assumed SC-1 which hadn't set had bound fines together which didn't allow them to swell and plug soil pores. Dug down in small area at 0+32 to and around pipe. Fine soil well saturated in confines of trench in all places, but no free SC-1. Interior of clods had SC-1 in fine passageways. Dug down at end of trench to bottom. Soil well permeated. All soil had appearance of plant mix with no fines evident. Close examination revealed them bound together. Trench wall at 18 inches below surface permeated 4 inches to 6 inches from surface in pores. Will dig up other portions of test later to determine setting time of SC-1.

8/21/58 - Camozzi dug holes at corporation yard and filled three 5 gallon buckets with adobe for test - makes 5 total. Camozzi filled five 5 gallon buckets with Fifth Street soil.

8/22/58 - Went to corporation yard about 8:30 a.m. and got tests under way for permeation of soil by various cut back asphalts. Prepared 10 five gallon cans as follows: Dirt had previously been tamped in each up to 4½ inches ± from top. One quart oil can with both ends removed set in center of five gallon bucket and dirt tamped around quart can to top of bucket. Five were prepared like this using adobe soil as found in corporation yard and five with soil as obtained from Fifth Street, Boyes Springs. Each soil was judged to have an optimum moisture content for maximum compaction. Note - 1 inch pea gravel placed in bottom of each bucket. For each soil type one bucket was used of RC-1, MC-1, SC-1 and air blown cut back asphalt (from Trumble). One bucket of each soil type was left untreated for control in later tests. Hole was punched in side of each bucket and in very bottom and quart oil can placed to catch drip. Refilled quart can in top of SC-1 test bucket set up last Monday. It was completely empty. Set quart can to catch drip, time 9:45 a.m. 11:26 a.m., air blown to adobe seems to be taking material much faster.

D. E. Bean's Notes - Volume 1, page 16

The table of estimated drops: 11:40 a.m.

Fifth Street (soil)	Adobe (soil)	Asphaltic Material
1/2 inch	3½ inches	Air blown
1 "	2 "	SC-1
2 "	1½ "	MC-1
1¼ "	1½ "	RC-1
	1:10 p.m.	
1 " *	4¼ " *	Air Blown
2 " *	3½ " *	SC-1
3 " *	2 " *	MC-1
3 " *	3 "	RC-1

*Refilled to top.

Refilled to top. Adobe SC-1 bucket shows SC-1 coming through surface of dirt at 3:00 p.m. Some ran over edge of bucket. Opened clod (dry) submerged in RC-1 since last Wednesday. Found RC-1 in pores and fissures similar to tests with SC-1.

8/25/58-9:15 a.m.

Fifth Street (soil)	Adobe (soil)	Asphaltic material
2 7/8 inches	2 3/4 inches	Air blown
1 1/2 inches	*	SC-1
2 1/2 inches	2 3/4 inches	MC-1
2 3/8 inches	2 3/8 inches	RC-1

*Material had come through surface therefore no more added. All except Fifth Street SC-1 had come to surface. MC-1 dripping out of bottom at 11:00 a.m.

8/26/58 8:40 a.m.

Fifth Street (soil)	Adobe (soil)	Asphaltic material
1 inch	1½ inches (s)	Air blown
½ inch	2½ inches*	SC-1
½ inch	2 inches (s)	MC-1
½ inch	5/8 inch	RC-1

(s) Asphalt surfacing on bucket

*None added last time

No material was added to any of the buckets.

9:14½ a.m. One quart water added to 5 gallon adobe SC-1 originally setup on Monday, 8/18/58. Water appeared in drain at 9:16 a.m. with reservoir 2 inches from top. Reservoir empty at 9:25 a.m. but still trickling out bottom 9:36. 0.7 quart drained through.

8/27/58 - Added one quart SC-1 to first 5 gallon test bucket. Ran water through it yesterday. Time 2:50 p.m.

Volume 2 - D. E. Bean's Notes

9/15/58 - Went to corporation yard with Gene 3:30 p.m. Put one quart RS-1 in original SC-1 can at 3:33 p.m. Started dripping at 3:41.

9/16/58 - Went to corporation yard. Reservoir empty. "Catch" can 1/3 to 1/2 full. Added one quart RS-1 at 9:32 a.m. None came through before we left at about 11:00 a.m. Several weeks ago had poured one + gallons SC-1 on ground at yard. Poured one quart RC-1 on this and it readily soaked in. Second quart went in, too, but not as fast. Third quart seemed to be limit. Tried RS-1 on nearby similar ground (one quart) but seemed to puddle on surface. Second quart did same but spread over larger area.

9/19/58 - Gene and I went to corporation yard. Put one quart water in original SC-1 test bucket and one in SC-1 Fifth Street bucket. Fifth Street came through in 5 minutes (started). Finished in short time. Cut open original SC-1 bucket. SC-1 had short cut around edge of can and through some fissures not completely permeated. RS-1 seemed to be every place SC-1 had been. Dug hole in previously treated SC-1 backfill at upstream end of test. Half depth to backfill previously removed. Placed 7 gallons RS-1 in hole. Began leaking slightly through bank 2 feet away (dug to bottom trench). Also some leaking in through cookie and wye at end of line. Small amount RS-1 in stand pipe at 0+21. Placed quart of SC-1 in to displace. Didn't work. Gene thought we might try SC-1 in this, followed by RS-1, but will check with MW. Phoned Tripp at 11:30 a.m. Told him to drive new satallite one foot south of 0+21. Place applicator and get one hundred gallons SC-1 in tank trailer to apply through 50 gallon barrel on 5 foot static head. Tripp will start at 1:00 p.m.

9/22/58 - Gene and I went to yard to look at asphalt pipe sealing test. Gene and South Park crew had placed new applicator at about 0+27 last Friday. Got pneumatic tank trailer full (to within 6 inches top) judged 150 gallons SC-1 Friday p.m. and transferred to 50 gallon barrels on 5 foot static head connected to applicator. Tom Goff refilled barrel Saturday, Sunday and Monday morning, each morning level in 50 gallon barrel had dropped to about 6 to 8 inches off bottom. Estimate total used equals 100 gallons to Monday morning.

9/23/58 - Gene and I went to yard. Walt and Tripp dug down 5 feet south of applicator. Found SC-1 from 1½ feet to 2 feet down. SC-1 found 5.3 feet to north of applicator 18 inches down.

9/24/58 - Dykes went to yard about 1:45 p.m. with Tripp. Will dig test hole southerly from applicator now on line to check distribution. Gene came back from yard. Dug down 4 feet south of applicator to pipe. Lots of SC-1 around pipe but not over 2 to 3 inches over top.

9/26/58 - Gene and South Park crew put RS-1 in applicator that had just received SC-1. 150 gallons used from approximately 10:00 to 4:30 p.m. See Gene's note book like this one for further details. (Note - Compare with reference on 9/22/58 in which 100 gallons of material was used in a 4 day period using the same applicator as opposed to approximately 6½ hours using SC-1 and RS-1 on this date 9/26/58. The previous sequence should reflect the fact that the applicator had been used for SC-1 prior to being used for RS-1 and that it took approximately 4 days for the SC-1 material to be used in the first case and 6½ hours for the RS-1 material to be used in the second case.)

9/29/58 - Went with Gene to corporation yard to watch Earl dig hole just downstream from cleanout on test pipe. Ground near pipe well saturated with asphalt. Material had all appearances of SC-1 but tenacity of RS-1. Entire area around pipe to elevation 10 inches ± over top saturated with material. Couldn't detect RS-1 in it but its tenaciousness identified it as RS-1. SC-1 was evident from shiny appearance.

10/2/58 - Went to yard with Gene to dig up more of RS-1 test (preceded by SC-1).

D. E. Bean's Notes - Volume 2, page 155

Referring to the sketch in this book: Dirt dug down to top of pipe here before starting in reference to Area A. Area at A had been dug down previously (last time out). Dug down in 4 to 6 inch lifts in B Area. Removed circular plug at 18 inch depth. Took pictures of hole and plug 4 feet south of "1". Dug hole 5 inches deep by 8 inches wide by 23 inches long in B area at 24 inches below ground surface. Filled with three gallons water. No noticeable drop in 17 minutes. Bailed water out 4:22 p.m. hole 18 inches south applicator at 2 feet deep filled with water. Left water in hole overnight.

10/3/58 - Went with Gene to yard. Water all gone from hole filled last night. No traces in ditch below. Refilled with water. Drop in surface noticeable. In few minutes water appeared on face of bank below and water draining from hole as if through channel. (Note - see sketch page 157 of these notes).

10/7/58 - Gene and I went to yard to check on hardness of asphalt in test backfill. Clods we broke apart seemed to be stickier within. Test hole we had poured water in was full of what appeared to be SC-1 only.

10/23/58 - Went over dry and wet weather pictures Sonoma Valley in the morning to determine good line to try asphalt sealing on. Will go over with Gene this afternoon to investigate in field.

10/10/58 - Gene and I left for yard to watch rest of asphalt pipe test uncovered. (Note - the following remarks will accompany the sketch in Don Bean's notes facing page 181.) First hit material at 12 inches depth midway between B and C. At 11:20 a.m. dug two holes in backfill (had excavated to 2 foot depth previously.) Filled with water. One hole in soil where asphalt had reached the other in what appeared to be non- treated soil. Came back at 1:50 p.m. Water gone from treated hole. Small drop in surface of untreated hole. Asphalt in backfill seemed to have set up more than last time out.

(More tenacious). Excavation showed asphalt material went no farther north from applicator than 3 feet. Dug hole along side vitrified clay pipe below point where applicator was. Edge of hole exposed pipe and pipe exposed on top. Filled with water but ran out in about 15 minutes. Spent whole afternoon on this investigation. Decided to try small scale test near Manhole 1-99 on Arroyo Road with three applicators Tuesday morning. Phoned Tripp and told him to have crew ready. (Note - End of Volume 2 at this point).

Volume 3 - D. E. Bean's Notes

10/15/58 - Walt left a little after 8:00 a.m. with truck tank trailer (200 gallons SC-1) barrels and pipe fittings to hook up test run on Arroyo Road near Manhole 1-99. (Note - the so called "SC-1" material which was used in these early tests and which was thought to be SC-1 was actually a cutback asphalt, cut back by use of diesel oil or other volatile material and actually represented only about a 25 per cent asphalt content as opposed to about 60 per cent in what would have been a certified SC-1 and finally, by the supplier's admission, the material that was theoretically SC-1 was not). Will connect 50 gallon drum to each applicator and fill with tank truck as they empty. I got there about 9:45 a.m. Walt had barrels connected. (Note - see sketch on page facing 190 of typical connection of 50 gallon drum and applicator) Filled all barrels to invert of bung hole with SC-1. Barrel No. 1 full at 10:29 a.m., No. 2 at 10:45 a.m., No. 3 at 11:00 am. At 11:45 a.m. removed plug from top of tee on No. 2 test. Observed SC-1 surface with gate valve for short time but no drop noticed. Same test tried with No. 1 at 11:40 a.m. and drop observed. At 1:15 p.m. test repeated with No. 1 and level in top of tee 1¼ diameter observed to drop 0.07 feet in 10 minutes. Same test with No. 2 and No. 3 showed 1/16 inch drop in 30 minutes on No. 2 and 1/8 inch drop in 30 minutes with No. 3. Went to Rogers about 2:15 p.m. to phone Gene and give him information. RMB said he would be over about 3:20 to 3:30 p.m. We went back to test site and Gene got there at 2:45 p.m. Showed Gene how it dropped in top of tee with gate valve closed. Decided flow so slow we would go home and come back tomorrow. We did. (Note - on the bottom of page 192 is a sketch of the dimensions of the 50 gallon drum used.)

10/16/58 - Gene and I went to Sonoma Valley to look at test on on Arroyo. No noticeable drop in each of the three barrels. Removed plug from tee on each applicator and closed gate valve. No. 1 dropped 3/32 inch in 10 minutes, No. 2 and No. 3 didn't drop in 15 minutes time - 9:00 to 9:30 a.m. Decided to try 5 foot length of pipe in top of each tee filled with SC-1 (gate valve closed) to boost static head. Will try diesel oil in either No.2 or No. 3 and SC-1 in others. (At the bottom of page 194 is a calculation to determine the volume of the barrel to the invert of the bung. Calculated volume equals 47.3 gallons.) Walt and I went to test on Arroyo at 2:30 p.m. Put 5 foot length and plugged end of each tee. Filled No. 1 and No. 2 with SC-1 and No. 3 with kerosene (valve to barrel shut off). Waited til air bubbled out then refilled. No. 1 at 2:38½ p.m., No. 2 at 2:38 p.m., No. 3 at 2:37 p.m. Following readings taken on 1 inch round extension (No. 1 and No. 2 pipes had coupling on upper end) ID - 1¼ inches. No. 3 was bare pipe.

Time	Hole	Drop per Min.	Down
2:53 p.m.	No. 1	0.65 in.	15-16 in.
2:54	No. 3	.011 in.	3/16 in.
2:54	No. 2	0	0
3:04	No. 3	.038 in.	3/8 in.
3:04	No. 2	.006	1/16 in.
3:04½	No. 1	.071	1 3/4 in.
3:12	No. 3	.008	7/16 in.
3:12	No. 2	.008	1/8 in.
3:12	No. 1	.100	2 1/2 in.
3:30	No. 3	.011	5/8 in.
3:30	No. 2	.008	3/16 in.
3:30	No. 1	.076	3 7/8 in.
Note - Refilled No. 1 at 3:30 to 0 inches			
3:56	No. 3	.009	7/8 in.
3:56	No. 2	.005	5/16 in.
3:56	No. 1	.053	1 3/8 in.

Coupling on top of No. 1 and No. 2 removed at 3:58 p.m. SC-1 level with top after removal.

Time	Hole	Drop per Min.	Down
4:10	No. 3	.013	1 1/6 in.
4:10	No. 2	.005	1/16 in.
4:10	No. 1	.094	1 1/8 in.

Left for home, did not refill.

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10/15/58 - Went with Walt to Sonoma Valley. Made measurements shown on next page. Stirred up full depth No. 3 and refilled all pipes at 9:52 a.m.

Time	Hole	Down
10:30 a.m.	No. 1	7/16 in.
10:30 a.m.	No. 2	0
10:30 a.m.	No. 3	1/16

(No. 3 refilled at 10:46 a.m. with kerosene. No. 1 riser removed at 10:50 a.m. and placed on top of No. 2. Total height above ground 10 foot 1 1/8 inches. Filled with SC-1 at 11:59 a.m. This left No. 1 riser with section 11 inches long above top of tee (18 inch head). Elevation SC-1 in this section at top of pipe at 10:50 a.m., No. 3 down 1 inch at 11:03 a.m., refilled. No. 2 still full at 11:04 a.m. No. 1 down 3/16 at 11:05 a.m. No. 1 refilled at 11:05 a.m.

Time	Hole	Down
11:32 a.m.	No. 3	1 1/2 in.
11:32	No. 2	1/8 in.
11:32	No. 1	1/16 in.
11:46	No. 1	1/8 in.
11:48	No. 2	3/16 in.
11:48	No. 3	2 1/2 in.
1:28 p.m.	No. 2	3/16 in.

Time	Hole	Down
1:29	No. 3	6 3/4 in.
1:31	No. 1	1/2 in.

No. 3 refilled at 1:33 p.m.

2:08	No. 3	1 3/8 in.
2:08	No. 2	5/16 in.
2:08	No. 1	9/16 in.
2:20	No. 3	2 in.

Extension put on No. 3 brought top 83 inches above ground.

No. 3 refilled at 2:45 p.m. with kerosene. No. 2 riser extended and filled at 2:42 p.m. New height equals 10 feet. No. 3 down 1 inch at 2:45 p.m. While I was at plant Walt purged No. 1 and No. 2 holes below ground and filled with kerosene. Head above ground; No. 1 equals 18 inches; No. 2 equals 10 feet. When we returned No. 1 would drop when filled with kerosene very rapidly. No. 2 had picked up considerably. Gave instructions to Mel to open valves to barrels Sunday morning when lighting flares. However, we opened No. 1 valve Friday before we left.

10/20/58 - Went with Gene to Sonoma Valley to test. Removed risers on all barrels. No. 2 and No. 3 don't seem to be taking any material. SC-1 down 3¼ inches from bung invert in No. 1 barrel. No. 1 barrel dropped 3½ inches in 8 minutes (head above ground 18 inches). Went to Rogers and phoned Harold to tell Tripp when he phones at 10:00 a.m. to send Walt over with kerosene to be applied to No. 2 and No. 3 (displace SC-1 first). Went to Santa Rosa Corporation Yard and waited for Tripp and Walt. Repeated above to Walt and told him to put SC-1 back in pipes tonight. Walt took pickup to Sonoma Valley and Tripp drove us out to Adm. Bldg. and took No. 6. Gene went to Sonoma Valley to check test.

10/23/58 - Gene working with pipe sealing tests all day. See Gene's notebook for records of pipe sealing tests.

10/24/58 - Went with Gene to Arroyo Road Sonoma Valley in a.m. Walt and Gene had tried opening up applicators by applying high pressure RS-1 over short time interval in hopes of splitting open trench and allowing material to penetrate when small static head placed on the line. Walt finished doing this to No. 2 and No. 3 pipes which seemed to improve penetration considerably.

Trench split open slightly along south edge and little material oozed out when both No. 2 and No. 3 on high pressure (70 lbs.) Applicator placed by Gene and Walt previously between manhole and No. 2 and similarly treated yesterday or day before taking SC-1 nicely under small static head (barrel on ground). Looked up sewer in both directions from manhole No. 1-99 no SC-1 visible upstream but oozing through breaks and joints in several places downstream. Took pictures through mirrors (also took pictures SC-1 flowing through manhole downstream from Manhole No. 1-99). We left Walt applying small pressure to No. 3 (just sufficient to prevent break through pavement) and went to treatment plant about 1:30 p.m. (Note - Pressure cracking between the applicator and the pipe proved to be the key to the method of application.) Went back to Arroyo at 2:30 p.m. Walt put No. 1, 2 and 3 applicators back on gravity flow from barrel on ground. New one between manhole and No. 2 not on line. All barrels full.

10/27/58 - Went with Gene to Sonoma Valley test. Nos. 1 and 2 barrels were down 11 inches and No. 3, 1 inch. Removed plug from riser on No. 3 to observe drop without the barrel cut off. Drop in surface equals 3/16 ± in 5 minutes.

10/28/58 - Gene went to Sonoma Valley pipe test in the afternoon with South Park crew to get barrels to bring back and wash out. Gene came back from Sonoma Valley. No. 1 and No. 2 as originally numbered were both empty. No. 3 was down 1/2 inch since yesterday. No barrel on No. 1A. (Note - on the bottom of the page facing 236 is a sketch showing the placement of the barrels.) They removed barrels and brought home for washing. Plugged end of all applicators at ground level. Will place barrels on line full of RS-1 Thursday a.m.

10/30/58 - Gene to Sonoma Valley with Camozzi to put four drums on applicators on Arroyo Road, previously treated with SC-1. Will fill drums with RS-1 and let this soak in (near manhole 1-99). Gene called at noon to say they got upper three barrels full of RS-1 but ran out so came back to get more. Will return this afternoon. Ground is taking RS-1 at much faster rate than it did SC-1.

10/31/58 - Gene off to Sonoma Valley to feedRS-1 to Arroyo test with Tom.

11/3/58 - Tom had left four 50 gallon barrels connected to applicators last Friday (see Gene's notes for levels in barrels). Readings at 9:20 a.m.: Barrel No. 1 down from invert 12 inches; No. 2 (formerly 1A) 16 inches; No. 3 (formerly 2) 7½ inches; No. 4 (formerly No. 3) 9/16 inch. No RS-1 visible in manhole No. 1-99. Big glob in mouth of pipe entering downstream manhole No. 1-92. Almost looks like some RS-1 had come into manhole No. 1-92 from Verde Vista.

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11/5/58 - Went with Gene to Arroyo Road Sonoma Valley to check on pipe sealing test with asphalt. (See Gene's notebook for elevation of asphalt in barrels). None added since Monday. We looked in manhole 1-99. No asphalt evident. Large lump of asphalt still in mouth of line entering manhole 1-92 from manhole 1-99. Also I looked in manhole 1-91, 27 feet downstream from manhole 1-92. Appears asphalt had seeped thru base of this one in several places (small areas). Removed some with nail and end of stick. Appeared fresh and sticky. Some asphalt evident on sidewalls of pipe entering No. 1-91 from No. 1-92 that appears to have entered from higher up on wall of pipe and dribbled down. Perhaps lump of asphalt in mouth of No. 1-92 is from bad leak just upstream. There appears to be no obstruction in pipe that would have caused material to pile up here. If it had come from a number of small

11/5/58 cont'd.

leaks upstream, it seems it would have flowed through manhole without stopping. Gene and I are going over this afternoon with Tom Goff to refill barrels. (Cut sheets give the following dimensions. Note - on page 266 at the bottom is a sketch giving the referred to dimensions.) Readings on Arroyo Road barrels (from Gene's book) at 9:20 a.m.: No. 1 empty; No. 2 empty; No. 3 - 12 inches; No. 4 - 5/8 inch. Went to Sonoma to remove No. 4 barrel onto No. 3 applicator and turn the valve on at 2:26 p.m. Drained the small amount left in No. 4 into No. 2 barrel at 2:28 p.m. Valve left in original position (believed to be one turn), No. 3 down to 1 inch. Was formerly 5/8 inch (at 2:40 p.m.). Filled No. 1 to 6 inches down from bung invert at 2:49 p.m. In entering line of No. 1-92 looked up line with mirror, 2 inch layer of asphalt on invert as far as can see. Lots of roots coming from crown of pipe obliterates view last few feet. Walt got down into No. 1-91 to check on asphalt on base. Appears fresh. Also many spots around wall on first section. Lots of roots in line coming in from Verde Vista. No. 3 down 1 inch (as before) at 3:40 p.m. No. 2 down 11¼ inches at 3:40 p.m. (first measurement made since filling). No. 1 down 6 3/4 inches at 3:45 p.m. Checked ditch in property to north of manhole No. 1-99 for possible presence of asphalt. Also box culvert just downstream from No. 1-91 - negative. Walt said line coming into Manhole 1-92 from Verde Vista has joint just inside mouth that was leaking asphalt and made it appear from ground surface as if asphalt has been coming down pipe (as it was). Not enough sun to see up manhole No. 1-99.

11/6/58 - Went with Gene and Walt to Sonoma Valley Arroyo Road by Rogers to get extension light left by RNS. 2:30 p.m. readings: No. 1 down 9 3/4 inches; No. 2 empty; No. 3 down 3 3/4 inches. Looked up all three manholes with mirrors again. More asphalt had worked down to mouth of 1-92. Roger came along. Told him to remove with corkscrew tomorrow. Use water also.

11/7/58 - Met Roger and Dave Stevenson at Arroyo Road at 9:00 a.m. to rod out line. Borrowed sand trap from South Park. No. 3 down 5 3/8 inches. No. 2 down empty. No. 1 didn't measure. Roger and Dave shoved rod with corkscrew down manhole 1-99 and added water there with sandtrap at manhole 1-92. Asphalt very hard to get out. Few feet of line cleared at a time. Then cleaned corkscrew. To Arroyo Road at 2:45 p.m. Approximately 7½ gallons asphalt removed from manhole 1-92. Twenty-five gallons at manhole 1-99. 2:45 p.m. No. 1 empty. No. 3 down 6 inches. Roger and Dave close to finishing rodding of line. Using water from house north of manhole 1-99 for flushing. Ran tank dry.

11/12/58 - With Walt and Gene to Sonoma Valley Arroyo Road. All barrels empty. Looked downstream in manhole No. 1-99. Looks clean, no asphalt left on invert. Couldn't notice any on pipe joints either. Opened manhole 1-92 to look but sandtrap still in place and water backed up. Looked in manhole 1-91 appears many more spots of asphalt on base than previously. Base on north side also appears much drier. Walt had scraped off a few spots on base where asphalt appeared last week. Some of these spots of asphalt had reappeared.

11/28/58 - Gene and Harold to corporation yard 1:00 p.m. to look into construction of test apparatus to photograph pipe interiors in place.

Volume 5 - D. E. Bean's Notes - page 461

Spent day working with Gene to pick out pictures representative of our tests on sealing pipe with asphalt. Will also show some dry and wet pictures of various manholes. Showing will be some time next week.

1/22/59 - Gene and I took some selected Sonoma Valley slides into old coffee room with projector and screen and sorted them over to get most interesting slides. Projection time takes 37 minutes.

1/23/59 - Spent morning working up dry and wet weather flows for pictures selected for Board of Supervisors.

D. E. Bean's Notes - Volume 7

4/3/59 - Gene to Sonoma Valley to experiment with drilling test holes.

4/7/59 - Scheufel off to Sonoma Valley with South Park crew to place new lot of applicators for asphalt pipe sealing tests on Arroyo Road. Believe it is upstream from manhole No. 1-99.

4/9/59 - Gene left first thing in morning to shoot SC-1 into applicators above line between manhole 1-99 and cleanout above Arroyo Road. Walt placed valves in wall and base of No. 1-99 yesterday to observe oil flow.

4/15/59 - Went with Gene in afternoon to Arroyo Road test in Sonoma Valley to get familiarized. They have shot SC-1 in applicators spaced 30 feet apart starting at 4 feet upstream from manhole 1-99 to end of line. (Note - This was the first attempt to standardize on applicator spacing. Later proved that 30 feet apart was too far apart. First step is to treat under pressure to crack soil over pipe and then small amount under gravity flow from barrel on ground.) Gene intends to put RS-1 in Friday under gravity flow.

4/17/59 - Gene to Sonoma Valley to put RS-1 in Arroyo test. Went to Arroyo Road in Sonoma Valley to watch tests Gene conducting with asphalt sealing process in afternoon. He was putting RS-1 in by gravity flow from barrels. Line had been treated with SC-1 previously.

4/23/59 - Gene to Arroyo Road after morning meeting.

Volume 8 - D. E. Bean's Notes

5/4/59 - Spent most of day at corporation yard with Walt conducting experiments with reaction of salt solution and RS-1. Used rock salt. One quart RS-1 in gallon bucket. Solution of one teaspoon salt in one quart water added by dropping slowly in. Asphalt spearated immediately. One quart of solution gave ball about 3 3/4 inches in diameter. Mixed another quart of same strength solution and got 4 inch diameter ball from same can. Another can of same strength gave 3/4 inch diameter ball. Only brown colored water left with flecks of asphalts. Next tried 1/4 of one quart RS-1 in can and added clear water (from same can which had previously contained salt). This was dropped in from height and precipitated immediately probably due to traces of salt in can. Repeated test after rinsing can more thoroughly and let flow together smoothly by tipping can and letting salt solution run down side into RS-1. No precipitation occurred until agitated. Tried straight water and RS-1 dropped them both slowly into can. Precipitation occurred in agitated area but none further until we added some salt water which was allowed to enter RS-1 without agitation but precipitation occurred immediately anyway. Tried mixing two teaspoons salt with one quart water and let run slowly without agitation into one quart RS-1. Precipitation not as fast as No. 1 test where it was allowed to drop in and agitated. 3½ inch diameter ball of asphalt formed. Repeated test with remaining RS-1 and got another ball 4 inches in diameter. Two tablespoons salt in one quart water let run slowly into one quart

RS-1. Slow precipitation until agitated then two inch ball removed. After setting for a short time took on curdled appearance which didn't settle out as before. When stired goes back into solution. Let set during noon hour when came back there was definite separation between asphalt and water. When Walt tried to remove with hand it had a curdy consistency and hard to get it to go into one mass. With small amount of agitation it went back into emulsion. One quart of water with two tablespoons salt dropped into one quart RS-1 from height so as to agitate. Caused rapid precipitation. Let set for 15 minutes and completely separated. Asphalt not as homogeneous as with lesser salt concentration, and is more crumbly not plastic. Repeated No. 1 test using one teaspoon salt in one quart RS-1 dropped in so as to agitate. 3¼ inch ball the first time and 3 3/4 inch ball on second treatment. Tried chilling RS-1 with blast from CO_2 gun. No good. Placed some of the solid CO_2 in RS-1. It froze adjoining RS-1 but upon thawing returned to emulsion. Tried hot water bath on RS-1. Only lowered viscosity. Addition of hot water to RS-1 only thinned it out. Rock salt crystals added to RS-1. Dropped to bottom but collected asphalt around each crystal.

5/5/59 - To Arroyo Road with Gene to dig up asphalt test to observe results. Trench about 6 feet long. Three feet each side of No. 8 applicator about where wye is to vacant lot on east. First pictures at about 18 inch depth. Asphalt found at 25 inche depth. Spent day there observing results.

5/6/59 - To Arroyo Road with Gene. Anderson with backhoe got there at 9:00 a.m. Dug about 4 different holes at intervals along the line to observe results. Results were spotty. In areas where gravel bedding had been placed material had remained in gravel without contacting pipe. In other areas there was no material at all, due according to Gene, to the fact that the flow of RS-1 had been cut off over weekend and allowed to set up in applicator. Following points are to be presented to Board of Supervisors next Monday. No. 1 hole applicator placed 5 feet away. SC-1 applied. In two minutes time SC-1 appeared in top test base of manhole. Note - hole at intersection taper section and wall on outside. Also note boulder on trench wall placed over pipe. Manhole when plugged on inlet showed water at base joint. No. 3 and No. 4 applicators blew up. No. 4 at oak tree. RS-1 never went in. No. 4 applicator excavated and RS-1 found indicating it had come downstream 40 feet from No. 5. No. 5 applicator was given all it would take. Five house services treated. Took lots of oil (meaning asphalt). Carlin house service and vacant lot hard to stop. Carlin's slowed down by added salt water. Ten minutes to make hole, twenty minutes total. SC-1 no pressure preceding RS-1 on house service. Applicator put in end dug hole along side pipe. Applicator that blew split trench from top to bottom. Hole above Carlin's didn't have applicator. No. 7 applicator is just 5 feet upstream with gravel layer beneath pipe. Took lots of SC-1 without showing in manhole. RS-1 went in fast, too, but seemed to come right through to manhole. One house service just upstream from No. 7

5/6/59 - No. 8 applicator in hole at wye to broken house service. RS-1 all the way around. No. 9 applicator 3 feet from north end of excavation. No. 10 applicator at south end of excavation. Beer can beneath pipe.

5/7/59 - Gene and Harold Ruebenack to Sonoma Valley to show experiment to Marshall Wallace.

5/11/59 - Went with Gene to Sonoma Valley while he showed Board of Supervisors around Arroyo Road experiment.

Volume 9, D. E. Bean's Notes

7/10/59 - Made list of existing pictures of manholes on line tributary to Arroyo and highway to Arroyo.

7/17/59 - Put pictures away that I had pulled out showing dry and wet weather shots of all manholes on line up Arroyo tributary to manhole 1-64 at Highway. Their serial numbers are as follows: 1-0071 to 1-0086 inclusive. 1-0034, 1-0439, 1-0484 to 1-0500 inclusive. 1-0630, 1-0644, 1-0802, 1-0922 to 1-0924 inclusive. 1-0928 to 1-0131 inclusive. 1-0973 to 1-0975 inclusive.

Volume 10, D. E. Bean's Notes

8/3/59 - Gene to Sonoma Valley to work with asphalt sealing.

8/4/59 - Gene and Dave Goodman to Sonoma Valley on asphalt sealing tests.

8/5/59 - Gene and Dave to Sonoma Valley again.

8/7/59 - Went with Gene to Sonoma Valley to witness asphalt sealing experiment in the morning on Central Avenue.

8/10/59 - Gene, Scheufel and Dave Goodman to Sonoma Valley to put RS-1 in seal test on Central Avenue.

8/19/59 -- Gene, Dave Goodman and Bob Scheufel to Sonoma Valley for pipe seal tests. Marshall Wallace (County Sanitation Engineer) in to ask that summary of costs spent on figuring some way to repair Sonoma Valley leaks and cost of doing these things including Splude Road be prepared, before meeting of Water Pollution Control Board at Oakland tomorrow at 1:00 p.m. Gene asked me yesterday to get together photos of LID 2 that can be used for before and after comparisons on seal test to be conducted in LID 2. Marshall Wallace wants to spend rest of month in LID 1 and then move to LID 2. Manholes selected for Gene's consideration are as follows: 2-18, 2-26, 2-27, 2-28, 2-29, 2-30, 2-31, 2-46, 2-52, 2-55, 2-56, 2-58, 2-59.

8/28/59 - Went with Gene in afternoon to Central Avenue in Boyes Springs where they are working on sealing experiment. Have applied standard amount of SC-1 in applicators but RS-1 has never shown up after its standard dose. (SC-1 never showed up either). They will be adding more Monday. This is on a steep grade and porous strata may be draining it off.

9/3/59 - To Sonoma Valley with Gene in morning. Stopped by Central Avenue sealing tests and treatment plant.

D. E. Bean's Notes - Volume 11

9/24/59 - Went with Gene to Sonoma Valley in morning to look at asphalt seal test on Verde Vista.

9/28/59 - Gene to Sonoma Valley in morning to work on sealing. (Note - Rainfall figures of heavy September rain at this stage of line sealing was reflected in heavy flows in the line on Central Avenue. Subsequent sealing around culvert reduced amount to flow)

10/6/59 - Paul Reimer, vice president of George S. Nolte, consulting CE in to find out if asphalt sealing process working out.

10/27/59- Gene and Scheufel to Sonoma Valley for sealing. Scheufel called to have Tripp take load of barrels and pipe fittings to Bay Street in Sonoma Valley for sealing experiment.

10/29/59 - Left Santa Rosa at 12:30 p.m. after picking up pipe fittings and took them to Gene at Sonoma Valley. Went over job with him. Some asphalt showing up in breaks or knot holes in tree trunk in Central Avenue. Have just started on alley off Bay Street.

11/2/59 - Went to Sonoma Valley with Scheufel. Met Gene at Central Avenue. He asked that I order four sets of neopreme gaskets for portable pump. Did so at treatment plant.

D. E. Bean's Notes - Volume 12

12/8/59 - Gene says freezing weather has caused RS-1 to set up in applicators on pipe sealing experiment.

12/9/59 - Went with Gene to Sonoma Valley asphalt sealing tests in afternoon.

12/11/59 - Checked with Walt on alley off Bay Street on asphalt sealing tests.

12/15/59 - Gene asked that I locate sewer cleaning ball to use in asphalt sealing tests. He wants to put salt water in behind it to force out thru joints and set up RS-1 on outside of pipe. Phoned McKinney of city. He offered to lend us his. SIDU of Long Beach manufactures them. No such place according to local switchboard operator. Went with Tripp to city treatment plant to pick up 8 inch ball with rope reel and reel holder from Al Hardt. Art will try to locate 6 inch ball and notify us. Tripp and Gene got 6 inch sewer ball from city treatment plant in afternoon.

12/16/59 - Gene to Sonoma Valley to experiment with sewer cleaning ball to force salt water out through pipe cracks to set up RS-1 on outside of pipe.

12/27/59 - Went with Gene to Sonoma Valley to watch experiment of forcing salt water out through pipe out through pipe joints by use of sewer cleaning ball, to set up RS-1 on outside of pipe.

D. E. Bean's Notes - Volume 13

12/22/59 - Went with Gene to Sonoma Valley asphalt test on alley off Bay Street.

12-23-59 - Rained about a half inch last night. Gene and Dave to Sonoma Valley with camera.

1/4/60 - Went to Sonoma Valley Central Avenue. Walt said they "cracked" applicators Thursday morning and left them on for weekend. Only the ones on the house services moved and they were in dug holes. We called Gene and he says to try cracking with straight diesel oil.

1/5/60 - Went to Central Avenue, Sonoma Valley, to check with Carl on asphalt sealing. They tried diesel oil containing small amount of SC-1 yesterday. "Cracked" applicators with this and left running. Results were not too good. Are going to try solution today containing more SC-1.

1/6/60 - Went with Gene to Sonoma Valley to visit asphalt seal test on Central Avenue. They were cracking applicators for fourth time since installation. Were using SC-1 cut with diesel oil. Some of the bsrrels showed signs of taking it.

1/8/60 - Went to Central Avenue, Sonoma Valley in afternoon with Gene to check progress of pipe sealing work. Had tried cracking with RS-1 but progress not too satisfactory.

1/12/60 - Worked three hours preparing sketch for patent for pipe sealing process.

1/14/60 - Gene to San Francisco with Ramsey to contact patent attorney about patenting pipe sealing process.

D. E. Bean's Notes - Volume 14

2/18/60 - Bob Scheufel to Sonoma Valley to locate some house service cleanouts for sealing crew.

3/11/60 - Casey Jones in to discuss asphalt materials. He arranged for us to pickup 5 gallons certified SC-1 from Young and Engelke. Jones says McPhail's RS-1 and RS-K will be bonified material and we will use them in bucket experiments. Arranged with Tripp to go Healdsburg with Poore to pick up SC-1. Will conduct some tests this afternoon. Went to Young and Engelke with Poore in afternoon. Got 5 gallons SC-1 free. Set up four test buckets at corporation yard and filled two with dry sand and two with wet. (Note - on page 1300 of Volume 14 is a sketch of the test setup.) Set quart can in top in about half out of sand. Sand scooped out of inside. Filled all four quart cans to top with SC-1 at about 4 p.m. Wet sand seemed to be taking SC-1 more rapidly than dry. By 4:30 p.m. wet sand had dropped 1/2 inch and dry about 1/4 inch.

3/15/60 - The following amounts of SC-1 were added to test buckets since Gene and I left on Friday at 4:30 p.m. in the afternoon. (Note - the table referred to is on the top of page 1302 in Volume 14.) Larger flow in No. 1 wet due to fact that it received more sunshine than other, consequently more heat. Went to yard with Gene at 8:15 a.m. No. 1 wet was empty at 9:00 a.m. Tuesday (down 4½ inches). (Note - there is a summation of total amounts that the samples went down on page 1303.) Reservoirs in dry buckets empty. Then mixture of 15 per cent diesel in SC-1 added at 10:15 a.m. Holes punched in sand inside both reservoirs in dry buckets about 10:45 a.m. SC-1 showing inside pipe on No. 2 dry at 11:15 a.m. Tried small amount of water on top of sand where SC-1 has spilled on both dry and wet buckets. It was very slow to disappear in both dry and wet but dry was very slow. In afternoon had Walt set up four (2 dry, 2 wet) more buckets. Went to McPhail's and got 5 more gallons of what they call SC-1 which is actually fuel oil of some type. Filled reservoirs with this at 2:10 p.m. The new set up using McPhail's fuel oil as SC-1 was as follows: No. 2 wet leaking through at 2:50 p.m. No. 1 wet leaking at 3:05 p.m. (On page 1307 in another table indicating drops)

3/16/60 - Went to corporation yard about 10:30 a.m. Sample in No. 2 bucket (dry) now leaking into pipe (SC-1 pretreatment). Sample in No. 1 bucket (dry), SC-1 pretreatment, not yet coming through. Wet samples treated yesterday with McPhail's fuel oil emptied reservoirs during night and were not refilled. Will leave to drain. Dry samples treated yesterday with McPhail's not leaking through yet. Told Walt to keep these four dry buckets reservoirs full for rest of day and let the wet samples drain out.

3/17/60 - To corporation yard with Gene. Buckets with dry sand that have been treated with certified SC-1 diluted with 15 per cent diesel were set out in sun yesterday. Mix added as follows: 11:25 a.m. No. 1, 1 inch; No. 2, 3 inches. 4:45 p.m. - No. 1 7/8 inch; No. 2, 2 1/4 inches. Went dry over night. No. 2 leaking bad. No. 1 not showing any leaks. Added 5½ inches to No. 1 dry of first test (SC-1 cut 15 per cent) 5 gallons RS-1 and RS-K from McPhails. Ran small tests with these. RS-K stuck very well to wet and dry pipe, in comparison to RS-1. RS-1 percolates much better into dry or wet sand and into sand penetrated with diesel or RS-1. (Note - on pages 1316, 1317, 1318, are four small tables comparing RS-1 with SC-1 pretreatment, RS-1 with fuel oil pretreatment, RS-K with SC-1 pretreatment and RS-K with fuel oil pretreatment).

3/18/60 - Hardly any drop in any of RS-1 or RS-K samples. Polked several holes to bottom of bucket with rod in SC-1 pretreatment (wet) both RS-1 and RS-K samples. Samples took material rapidly thereafter. Came through cracks in pipe rapidly at first and then sealed them off. Spent 6 hours on these tests. Tried placing one cup RS-1 in half pint soapy water. No breaking observed. Let this percolate through wet sand but asphalt filtered out through top. Recommend that RS-1 only be used to seal badly since it may tend to seal off sides and bases of passageways whereas SC-1 percolates through.

Volume 15 - D. E. Bean's Notes

3/21/60 - Wright of McPhail's called to ask if we know SC-1 is supposed to be heated from 100 to 175° Fahrenheit for proper application. He has about 9000 gallons fuel oil on hand now that we have been using. When this is gone he will put in SC-1. If we want it sooner he will pump out fuel oil and put in SC-1. Doesn't want to do this unless sure we want SC-1. Agreed that he will deliver 200 gallons SC-1 to El Verano Corporation Yard 9-9:30 a.m. Wednesday morning. We will try this and let him know.

3/24/60 - Gene to Sonoma Valley on asphalt experiment. Went to Sonoma Valley with Gene in afternoon to look at test with certified SC-1 on Los Lomas south of Arroyo. Four barrels broken with fuel oil and one with SC-1. All now have SC-1 in them and are dropping satisfactorily. Came back by way of corporation yard and looked at asphalt tests.

4/8/60 - To Sonoma Valley with Gene to check asphalt sealing in afternoon.

4/11/60 - Went with Gene to corporation yard in morning. Put SC-1 in two buckets of sand we had tested with water last week. After pretreatment with SC-1 and RS-1 in one and RS-K in other, stayed til noon. SC-1 is permeating but very little leakage evident. Went to yard before 5:00 p.m. SC-1 percolating through at slow rate and leaking in places. Walt has been keeping buckets full of warm SC-1.

4/18/60 - Spent morning at corporation yard with Gene. Put water in the two buckets that have been draining for some time after application of SC-1. One bucket previously treated with RS-K took water at slow rate until it appeared air bubbles in sand had been displaced then percolation seemed to stop. Bucket previously treated with RS-1 was treated with RS-1 in small area. Very little RS-1 taken in.

4/22/60 - Went to Sonoma Valley, Arroyo Road to take pictures.

4/28/60 - To corporation yard with Gene at 4:00 p.m. to look at asphalt tests. Asked Tripp to have buckets bailed out (SC-1) tonight. Will let drain till next Monday or Tuesday then water test.

5/9/60 - Went with Gene to South Park corporation yard at 10:00 and refilled the two 5 gallon test buckets with SC-1. They have been draining since application with water last week.

5/10/60 - To corporation yard with Gene. SC-1 has dropped considerably since added to buckets yesterday morning. Agreed to let drain before proceding.

5/11/60 - Stopped in corporation yard. No. 1 bucket down so sand visible. Asphalt leaking through drain hole. No. 2 can empty. No. 1 bucket leaking around pipe through can.

5/12/60 - Gene asked Tripp to make set up to try RS-1 in quart can reservoir in one of test buckets. Gene checked this out in afternoon.

5/19/60 - To Sonoma Valley with Gene to see first load SC-2 tried on pipe sealing. Were filling barrels on Vallejo Avenue north of Arroyo. Brought back two gallons. Added some to No. 1 bucket at corporation yard. Filled No. 2 bucket with water. Bob Bell called to say SC-2 is going slow, cooling off. Will check levels in morning and phone Gene.

5/25/60 - Went to corporation yard with Gene. Added water to test buckets previously treated with SC-2. Came back by way of corporation yard. Only leakage visible in buckets is in weep hole in No. 2 bucket. Asked Walt to place 5 gallon bucket lid on top on No. 1 bucket with 1 inch riser pipe attached thereto. Walt phoned to say two foot riser used after filling with water set up began to leak at the point where sewer pipe goes through bucket and at breaks in pipe within 3 minutes. Gene went to yard. Said bad leak due to removing quart can reservoir from top of can. This removed cone of sand down to near pipe. Will retest by filling this with sand and impregnating with SC-2.

5/26/60 - Gene to Sonoma Valley to get more SC-2 for corporation yard experiment.

6/2/60 - Went to Sonoma Valley with Gene to watch attempt to place RS-1 block in trench below manhole at Central and Las Lomas by placing RS-1 above and salt water below. Seemed successful as RS-1 built up into weep pipe in manhole where SC-1 has never been before. (Note - This was the first attempt to block RS-1 in hilly terrain or in areas where the line was at a very steep grade by using the salt water downstream at the manhole, the RS-1 was successfully blocked and the method of determining the level of the RS-1 was determined through the use of weep holes and/or risers in the manhole.

6/27/60 - Walt says experimental asphalt RS-1 in 5 gallon bucket down 4½ inches since Friday. Weep hole appears to be drying up. They started wagon drill this morning and are working down toward highway. No barrels are on.

7/11/60 - Went with Gene in afternoon to Sonoma Valley to see excavation on Las Lomas. Soil surrounding pipe well saturated with asphalt.

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8/24/60 - To Sonoma with Gene. Watched operations on Calle del Monte. Drilling holes for applicators.

D. E. Bean's Notes - Volume 20

12/1/60 - Rained hard last night. To Sonoma Valley with Bob Scheufel for all day to shoot pictures on treated sections. Following are manhole observations. 1-94 through flow about 1/2 inch deep more than normal. Small flow from weep pipe valve. 1-93 little pickup trickled from the west. 1-99 normal flow east weep pipe dripping. 1-92 about normal from Verde Vista. Normal from Arroyo. 1-91 no flow from Verde Vista. Through flow above normal. 1-90 flow from south above normal. Large flow from north. East flow above normal oil slick. 1-98 low flow appears normal. 1-97 flow from 1-98 above normal. Also flow from west above normal. 1-96 flow from north and west above normal. Total flow approximately half above normal. 1-95 no flow from east through flow above normal. About one quarter depth of pipe. 1-90 green appearing from both north and south. 1-89 both directions above normal. 1/4 to 1/3 depth through pipe. 1-88 through flow 1/3 to 1/2 depth. North and south flow at or below normal. 1-87, 1/3 pipe depth. Specks of oil. 1-86 no flow from Madera. 1/4 to 1/3 through flow depth. 1-85, 1/4 to 1/3 depth. No water in creek along Arroyo at 10:45. Arnie says there was earlier this morning. 1-64 flow considerably above normal. Lots of turbulance. 1-68 low flow normal. 1-67 big pickup from 1-68. 1/3 depth through flow above normal from Vallejo 1/8 depth. 1-66 through flow at 1/4 depth. South alley above normal. RS-1 or SC-1 entering line at junction wye and main and through line. 1-65, 1½ normal. Seems to be less than entering 1-64 along highway. 1-29 small trickle. 1-28 normal. 1-27, 1/3 depth from Bains. 1/3 depth from Vallejo. 11:56 a.m. no evidence from City of Sonoma manhole on MacArthur and Donner. Took shots at Splude Road at noon, was overflowing. Discharge flap gate surcharged. Afternoon 2:00 p.m., 1-94 above normal. Weep pipe still trickling. 1-93 normal from east trickle from west. 1-98, 1/4 inch depth of flow from the north. Normal from east. 1-97 above normal from 1-98. Normal from west. Trickle from weep pipe. 1-96 flow from west - shouldn't be. From north just about normal and weep pipe dry. 1-90 trickle from south. Other pipes 1/4 to 1/3 more than normal. 1-95 nothing from Farnsworth. Heavy slick on through line. 1-91 nothing from south. Through line above normal and fast. 1-92 both slightly above normal. 1-99 same flow as arriving at 1-92. East weep pipe still only one dripping. 1-89 small stream above normal from Cuneo. 1-88 through flow just a little above normal. Side streets normal.

12/2/60 - To Sonoma Valley in afternoon with Gene to look at treated manholes.

1/6/61 - Worked on patent for Sonoma Valley sealing process.

1/11/61 & 1/12/61 - Worked on Sonoma Valley patent.

1/13/61 - Went to South park corporation yard with Gene in morning. Ran tests with RS-1 to see if it would follow alkaline solution through sand as claimed by Hulst. Tried three cans one pretreated with SC-1, one with 1/3 quart solution of 2 tablespoons lye to one quart of water, and one with no pretreatment. No. 2 and No. 3 both coagulated on surface of sand. SC-1 pretreated acted in usual manner with only slight coagulation on sand surface. Small amount of above mentioned lye solution added to RS-1 in can caused RS-1 to coagulate in very short time. Worked six hours on Sonoma Valley patent.

1/16/61 - Worked 6 hours on Sonoma Valley patent.

1/18/61 - Spent most of day on Sonoma Valley patent.

1/20/61 - Five hours on Sonoma Valley patent.

1/25/61 - Finished writeup on Sonoma Valley pipe sealing patent.

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2/3/61 - To Calle del Monte to watch sealing with Gene. Are cleaning out pipes leading to applicators. RS-1 set up in them. (Note: Observed that freezing temperatures breaks RS-1)

2/27/61 - Al Hahn of E. R. Bacon called to say that their No. 101 Little Ford oil distributor, he is informed by the factory, would be quite capable of providing 100 gallons per minute as transfer pump and 5 gallons per minute at 100 p.s.i. Says 5 gallons per minute at 100 p.s.i. horsepower requirement (theoretical) is 3 horsepower. It may take gear reducer to handle this. He will send information showing how piping is arranged. Says our specs should call for 25 feet of discharge hose less discharge fittings. Specify no spray bar capable of handling hot SC-1 and RS-1 at 100 p.s.i. at 5 gallons per minute and 100 gallons per minute as transfer pump. Price will be less than $3,000.

2/28/61 - Stu McCullough of Ricks, Co. selling White Company oil distributors in to give pitch on their 325 gallon unit. Will get us back complete information by last of week or first of next.

3/9/61 - Worked in morning on writing up specifications for oil distributor for Sonoma Valley. In afternoon went to Sonoma Valley with Gene to help locate leak in line on Las Lomas south of Arroyo. Tied dye bag to corkscrew on rod and fed down line to point where sharp rise dye intensity noted. Was definite point indicating large leak approximately 50 feet south of manhole at Arroyo.

3/10/61 - Finished specs. for oil distributor for Sonoma Valley and took to Petrey.

D. E. Bean's Notes - Volume 22

4/19/61 - Went to Sonoma Valley treatment plant with Gene in afternoon to see partly coagulated asphalt Mel had taken from treatment plant headworks. Appears to be SC-1 has lumpy, thick, curdy appearance. Appeared at plant shortly after large amount SC-1 had entered sewers near Maldanado.

4/20/61 - Phoned RMB in morning to ask him to prepare 2 five gallon buckets with 3 gallons SC-1 in each one for test. Placed half gallon of partially coagulated SC-1 Mel took out at plant in one bucket. RMB brought to South Park at about 3:30 p.m. Gene figures that it may be bacteria developing in sewer lines that are working on the solvent in the SC-1 causing it to partially coagulate. Gene and I went to South Park to work out with Walt how to disect a 5 gallon can we had been experimenting with last year. Can full of sand pretreated with SC-1. Lid put on with 3 or 4 feet one inch riser, to which RS-1 intermittently added to maintain head on sand. Practiced on another bucket.

4/21/61 - Gene and I met Walt at corporation yard. Cut pie shaped section out of can described in yesterday's notes. Many pictures taken. (Note - See sketch on the bottom of page 2042 in Volume 22) There was a layer of RS-1 on top of sand that varied from soft to hard. Upper three to four inches of sand very firm with set up RS-1. At start of original experiment holes had been punched with rod from sand surface to vitrified clay pipe. RS-1 had penetrated these holes and spread along pipe for a short distance. This was firm, and firmly set up. Sand below top 3 to 4 inches was stiff but not as hard as above this level. Assume this was penetrated by SC-1 that had now partially set. Hole dug in surface appeared to hold water under test.

4/24/61 - Went with Gene to South Park to see SC-1 test for coagulation by bacteria.

5/1/61 - To corporation yard with Gene in afternoon to look at SC-1 samples. Treated sample appeared no thicker than a week ago.

5/2/61 - Previewed pictures for Friday showing to Sonoma Valley committee.

5/4/61 - Spent most of day reviewing pictures for Friday showing.

5/5/61 - Afternoon showed pictures to Sonoma Valley committee of history of sealing developments. (Note - there are no line sealing notes in Volume 23)

D. E. Bean's Notes - Volume 24

11/30/61 - Worked on bill of materials for service entrance pole for metering station in Sonoma Valley.

12/1/61 - Spent day in Sonoma Valley with Andy photographing manholes. Hard rains last night and today. New metering manhole 1-60A running full. (Check rainfall figures this date)

12/4/61 - Received Bristol recorder for Sonoma Valley. Spent day drawing plans for box and piping system.

12/7/61 - 12/8/61 - Planned installation of metering equipment for Sonoma Valley manhole 1-60A.

12/11/61 - Went to South Park corporation yard with Gene to give Walt piping diagram for recorder box.

12/12/61 - Received filter for Sonoma Valley Meter. To South Park corporation yard to talk to Walt about constructing recorder box. Called Von Feely of Sonoma PG&E. He says to put our pole no less than 10 feet from theirs Northside and Gregor. Was doubtful that it would be considered temporary pole. The charge for connection to temporary pole $23.50. Agreed to install pole tomorrow. Get inspection and have PG&E connect Thursday.

12/13/61 - Went with Andy to Sonoma Valley. Showed Carl where to dig holes for service entry pole and pole for recorder at manhole 1-60A.

12/14/61 - Walt and Sonoma Valley crew just finishing recorder installation at manhole 1-60A. Gasket leaked on filter so unable to put into operation. Walt changed flume to one where bottom width equals 0.333 feet and depth equals .033 feet. N equals 0.7.

12/15/61 - Went with Walt to Sonoma Valley to put manhole 1-60A meter into operation. Cut new gasket for filter and installed. Filled oil pot for pressure relief. Walt measured flume as installed. (Note - See sketch on bottom of page 2341) Shut off flow into manhole and allowed water to drain down to bottom of throat of flume. Water depth measured .035 feet. Pen on recorder was set at this time. Plug removed from sewer and depth versus recorder again checked and was OK. Walt put flume that was in manhole 1-60A into manhole T-71. (As-built dimensions are on page 2343.)

12/19/61 - Went with Andy to Sonoma Valley manhole 1-60A. Changed chart to two-day drive. Pen oscillating at indefinite intervals of approximately 0120 feet leaving broad line.

12/20/61 - Went to Sonoma Valley to new meter manhole 1-60A. Increased air supply from 0.7 CFS to 1.8 CFS which caused pen to cease fluctuation. Put on two-day chart. Pen not set at liquid depth. Probably off 0.3 feet due to friction loss at higher flow (0.3 high.)

12/22/61 - In afternoon to Sonoma Valley 1-60A. Adjusted air to 2.0 c.f.h. and set pen to match depth with Bob Scheufel.

12/27/61 - Worked most of day on precise rating curve for manhole T-71.

12/28/61 - Worked all day on precise rating curve for manhole T-71.

1/3/62 - To Sonoma Valley in afternoon. Air line at entrance to pipe invert on 1-60A had silted up giving erroneous rating on gauge. Cleaned and fixed.

1/4/62 - To Sonoma Valley with Don Head. Visited Bob and Mel in morning. Walker phoned to say he is connecting to main on Thompson Avenue and finds applicators 4 to 6 feet to one side of the sewer line which is about 11 feet deep. No asphalt near pipe. Applicators completely missed trench and are in hardpan. Phoned Bob Bell to investigate. Bob Bell phoned back to say applicators only 29 inches off sewer and 7 to 8 inches out of old ditch.

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1/5/62 - Went with Bob Scheufel to Thompson Avenue, Sonoma Valley. Walker digging house service to south side of street about halfway between First and Second. Nearby applicator 27 inches off sewer centerline, but 8 inches ± outside old trench line. Other applicators from manhole 1-15 to Highway 12 are off the trenchline what appears to be a maximum amount of 33 inches from the centerline. Applicators from manhole 1-15 to 1-16 to 1-17 appear to be off varying amounts except at manhole 1-15. Shoved rod downstream from manhole 1-15 and M scoped again. Indicated that applicator is positioned OK but Walker's trench showed it off at least at the excavation. 12000 volt power lines run along side of Thompson full length which probably threw signal off.

1/8/62 - To Sonoma Valley with Andy. Bob Bell had dug exploratory hole on Siesta Lane which showed applicator to be directly over pipe line. The boys bored a hole over the sewer on Thompson at First and located the pipe with a probe. Applicators at this point proved to be 36 inches south of the sewer line. Crew will relocate applicator to trench centerline at barrels which have not "gone".

1/9/62 - Bob Bell phoned McPhail's. They will have new shipment of RS-1 in tomorrow afternoon. They are contacting Standard Oil man about what to do with filled up storage tanks.

1/12/62 - To Sonoma Valley with Andy to Siesta Lane. Agreed with Carl to replace SC-1 barrels on upper end with RS-1. Let balance of line set awhile.

1/22/62 - To Sonoma Valley to watch Bob Scheufel and Walt complete installation in Manhole 1-60A. Pen ran dry some time over weekend due to wide fluctuation of pen. Closed down on valve on line leading to recorder which kept surges from pen, resulting in less fluctuation.

2/2/62 - To Sonoma Valley in the morning. Met Scheufel, Carl and Bob Bell at T-71 metering manhole. Meter was started last Monday and hasn't dropped below 0.34 at any time (no rain). Water running in creek crossing sewer just upstream from T-71. Asked Bob Scheufel to check depth both meters.

2/9/62 - Spent most of day in Sonoma Valley with Andy shooting pictures.

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2/14/62 - To Sonoma Valley in afternoon to take pictures on all lines on Arroyo and tributary thereto.

2/28/62 - Bob Bell called to say they are taking up barrels on Thompson between the manholes 1-15 and 1-17. Those between 1-12 and 1-15 are still going and will be left. Second Street is receiving its final treatment.

3/16/62 - To Sonoma Valley in afternoon to run tests on line just upstream from meter at T-71. First plug entrance to manhole 1-100 and observed flow then both entrances to manhole 1-101 and observed flow and finally entrances to manhole 1-102. All plugs held tight and depth of flow recorded on meters. See memo in files dated 3/28/62. 2:17 p.m. plug in manhole first upstream. Flow dropped to 0.23 feet depth on recorder. Checked by Lloyd. Plug blew out. After only a few minutes replaced and flow dropped to 0.24 foot depth. Plug holding tight. No leakage. Two pictures taken and plug released at 2:55 p.m. Lowest point equals 0.21 feet before release. Eight inch line into second manhole upstream plugged at 3:09 p.m. holding tight. Six inch from laundry plugged at 3:10 p.m. Flow dropped to 0.235 feet (lowest). All plugs tight. Plugs released at 3:37 p.m. On test of whole line back to highway. Line from laundry plugged at 3:50 p.m. Others plugged at 3:58 p.m. All plugs tight. Flow dropped to 0.265 feet. Plugs out at 4:20 p.m.

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8/15/62 - Checked meter at T-71 in Sonoma Valley. Not working properly. Appears flow now below critical depth due to pipe relaying upstream.

8/16/62 - To Sonoma Valley with Bob Scheufel to check T-71 again. No good.

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9/18/62 - Studies returned patent papers for asphalt sealing process.

Robert M. Bell Notes

10/26/59 - No. 1, SC-1 black. No. 2, RS-1 brown. Walt Cioffi and I noted SC-1 at certain spots on an oak tree at the northeast corner of Central and Escondido Court. Upon close examination we found this SC-1 had spots on a half dozen trees along the street and on a tree on Verde Vista Avenue. On October 1, 5, 13, 20 and 27 there are notes which give the locations of applicators in various streets. October 1 lists those in Central Avenue. October 5 lists manhole 1-93 and 1-94.

October 1 also lists manhole 94. October 13 lists Central Avenue and Escondido Court, intersection between manhole 1-94 and cleanout 94-1. Applicators lettered A, B, C and D on October 13, 1959. Location soil description hard clay at top, granular. Hit wet spot 1½ feet from bottom. Note - these notes on October 13, 1959 refer to excavation at sites:

A - hard clay at top, hard granular. Hit wet spot 1½ feet from bottom. 5 inches water in bottom. Cave in at bottom one foot round.

B - hard clay at top, granular. Damp at bottom.

C - hard clay, granular, dry all the depth.

D - hard clay, slightly damp last foot of drilling. Hole at bottom 8 inches deep.

Following are excerpts from Gene Dykes' notes.

Volume 1

Sept. 26, 1958 - Friday - 150 gallons RS-1 turned on at 10:30 a.m. (filled to overflow. 11:00 a.m. 1-3/8 inches down. 1:25 p.m. 12½ inches down. Filled at 1:30 p.m. full. 1:45 p.m. 2¼ inches down. 2:15 p.m. 6 inches down. Filled at 2:20 p.m. 2:45 p.m. 5½ inches down. Filled at 2:50 p.m. Tank empty filled at 2:50 p.m. Filled to 4 inches from top of barrel. 150 gallons in ground by 4:30 p.m. (above pertains to South Park corporation yard tests)

Monday, Sept. 29, 1958 - Dug up south end of ditch near wye. RS-1 had penetrated and set up at this point. About 4 gallons of oil evidently an SC-1 and RS-1 mix was removed from north end of pipe. (Above pertains to South Park corporation yard tests)

Oct. 22, 1958 - Arroyo Street test 9:27 a.m. filled No. 2 and 3 stand pipes with kerosene (Note - on this page there is a sketch of an applicator in a dug hole). Tried putting SC-1 in loose soil from near hole. Penetrates very slowly. Put approximately one quart SC-1 in bottom of hole. Penetrates very slowly. Kerosene penetrates loose soil rapidly. Kerosene in pipe under 96 inch head start 11:19 a.m., stop 11:21 a.m. 6-5/8 inch drop. Soil test - (Note - there is a sketch that shows the fluid and soil arrangement) Warm SC-1 in at 2:09 p.m. out at 2:55 p.m. Second applicator in at 2:56 p.m. also says out 2:56 p.m. Second test - SC-1 50%, kerosene 50%. In at 2:10 p.m. Third test - Kerosene 100% in at 2:15 p.m. out at 2:16 p.m. Three charges put in can in approximately 20 minutes. Four shot - 100% shot of kerosene put in at 2:45 p.m. out at 2:54 p.m. Fourth test - stove oil 100% in at 2:37 p.m. out at 2:38 p.m. Second applicator in at 2:39 p.m. out at 2:50 p.m. Third applicator in at 2:51 p.m. out at 3:10 p.m. Fifth test - diesel 100% in at 2:40 p.m. out at 2:43 p.m.

Second applicator in at 3:44 p.m. Sixth test - SC-1 stove oil 50% in at 2:41 p.m. out at 3:10 p.m. Second applicator in and out at 3:13 p.m. Seventh test SC-1 50% diesel 50% in and out at 3:42 p.m. Results: after 100 per cent SC-1 (Test 1) entered soil the surface remains granular in nature. The 50 per cent SC-1 and 50% kerosene leaves a gelatinous scum on the surface as if asphalt is deposited on surface. Mixing of RS-1 and other fluids. 100% kerosene and RS-1 immiscible. No apparent breaking of RS-1. 100% stove oil in RS-1 immiscible. No apparent breaking of RS-1. 100% diesel in RS-1 more miscible than stove oil or kerosene. No. 3, kerosene and RS-1 in at 3:45 p.m. out at 3:45 p.m. (Correction - the application was started at 3:45 but never went out) No. 4, stove oil and RS-1 in at 3:45 p.m. At 3:45 p.m. started adding RS-1 to No. 3 (100% kerosene) and No. 4 (100% stove oil). At 4:00 p.m. added RS-1 to untouched soil in can No. 8. At 4:10 p.m. added water to untouched soil in No. 9 can. At 4:25 p.m. the SC-1 (50%) and diesel (50%). Note - the reference to cans in these notes is made to cans with perforated bottoms, and the cans were filled with soil that had been dug up at Arroyo and brought to the corporation yard for test purposes. Oil mix draining out of bottoms of both cans.)

Oct. 23, 1958 - Warmed SC-1 sample to around 130° Fahrenheit (estimated). Sample in 9:31 a.m. Kerosene and stove oil drained over night. RS-1 in at 10:12 a.m. (warm to touch. Pressure application of SC-1. (Note - on this page is a sketch of the method of application and also a table. These pressure application tests were made in the field and not in the laboratory or at the corporation yard tests. Note - again on the cans. These were 1 quart oil cans obtained from a service station with one end cut out of the cans and the other end perforated in order to give a standard size test can) Oily slick on water at manhole 1-99. Oil running into pipe and below applicator approximately 30 inches downstream from manhole. (There follows a sketch showing the applicators and a break in the pipe and manhole location). First joint downstream from manhole 1-99 leaking all the way around. This joint 18 inches downstream from manhole. Second joint had break out of pipe looking downstream. Lowest downstream applicator showed no oil movement under gravity. Hit with 60 p.s.i. several times before pressure started to drop. No. 1 gravity barrel dropping at rate of 3/16 inches per minutes before adding pressure. Dropping at rate of 8 inches per minute after hitting the 60 pounds per square inch pressure. Barrel refilled at 3:40 p.m.

Oct. 24, 1958 - Oil flowing by gravity through No. 1, 3 and 4 holes. All barrels filled as follows: No. 1 and No. 3 at 12:00 noon and No. 4 at 2:45 p.m. Total SC-1 used in experiment. Total from McPhail's equals 300 gallons. (Note - again this SC-1 was a cutback product and not actually SC-1, although it was sold as SC-1) Left in compressor tank equals 47 gallons (estimated). In No. 1 12:00 noon equals 47. In No. 3, 2:45 p.m. equals 47. In No. 4, 2:45 p.m. equals 47 gallons. Total 168 gallons. The difference between 300 gallons and 168 gallons represents the oil in the ground. Inspections of line downstream from manhole 1-99 shows SC-1 entering several breaks and porous spots in pipe. Inspection upstream shows no SC-1 entering pipe. Joints near manhole on upstream side look fairly good although roots entering joints further upstream.

Oct. 28, 1958 - Tanks removed at 1:45 p.m. No. 1, 17 inches below bung. No. 3, 17 inches. No. 4, 1 inch. Total estimated amount of oil used equals 132 gallons from the previous estimate. This is the corrected value plus 40 gallons at No. 1 plus 40 gallons at No. 3 plus 5 gallons at No. 4 equals a total of 217 gallons.

Oct. 30, 1958 - Tanks replaced and filled with RS-1 in the morning. (Note - on the same sheet is a sketch showing the location of applicators No. 1, 2, 3 and 4 around manhole 1-99) No. 1 applicators in at 10:41 a.m. Rate at start up 10 inches per minute. (Note - the movement in inches per minute is based on the use of a riser pipe which is in the line between the applicator and the barrel and has a valve between the riser pipe and the barrel. When the valve is open the applicator pipe is filled to the top. When the valve is closed and the flow is allowed to go into the applicator, these rates of movement in inches per minute are measured by a scale in the riser.) Rate on second try equals 9½ inches per minute. At 10:47 a.m. oil 1/2 inch below bung in barrel. Valve open wide. (Note - these are measurements in the barrel rather than in the riser pipe) 1:45 p.m. - 2 5/8 inches down. 3:04 p.m. - 3 1/4 inches down. Barrel refilled at 3:25 p.m. to bung.

10/31/58 - RS-1 down 4 inches from bung. This is No. 1 applicator. 9:15 a.m. refilled to bung. No. 2 applicator tank turned on slow at 10:55 a.m. Valve barely cracked. Oil 1/4 inch down from bung. Oil goes down applicator as fast as it comes from barrel. 1:47 p.m. - 1/2 inch down. Opened valve one more turn. At 2:35 p.m. checked intake of oil. Fell at rate of 4 inches per minutes. Therefore, opened valve completely. 3:07 p.m. 1 1 3/4 inches down. Tank refilled at 3:30 p.m. to bung. RS-1 down 8 inches 9:10 a.m. 9:20 a.m. refilled to bung. Valve opened only 2 turns. No. 3 applicator oil dropping 8 inches per minute at start. Oil opened at 11:00 a.m. Oil level 1/4 inch down from bung. At 1:50 p.m. two inches down. Rate at 2:42 p.m. of 4 inches per minute. At 3:08 p.m. - 2 5/8 inches down. Tank refilled at 3:32 p.m. to bung. RS-1 down 3 inches at 9:10 a.m. 9:25 a.m. refilled to bung. No. 4 barrel filled at 1:55 p.m. Rate of fall very slow. Put RS-1 under 18 p.s.i.'s starting at 2:06 p.m. Pressure reduced to 2-3 p.s.i.'s. (max. 4 p.s.i.'s) to keep RS-1 from breaking through. Pressure removed at 3:25 p.m. Gravity flow 1-1/8 inches per minute at 3:25 p.m. Tank refilled at 3:32 p.m. to bung.

10/31/58 - RS-1 down 1/2 inch at 9:10 a.m. Did not add any more RS-1 at the time. Manhole 1-99 checked down line with mirror. Oil had entered many cracks at joints. No RS-1 from upstream direction. Manhole downstream shows large blob of RS-1 washing into main channel. The total amount of RS-1 obtained from McPhail's was 300 gallons. As of 10 a.m. 10/31/58 approximately 260 gallons in tanks and ground. Of the 260 gallons approximately 228 gallons remaining in tanks or 72 gallons in ground in 24 hours.

Nov. 3, 1958 - Readings at 9:20 a.m.

Barrel No.	Down from Bung
1	12 inches
2	16 "
3	7½ "
4	9/16 "

Nov. 5, 1958 - RS-1 consumption

Barrel No.	Down from Bung
4	5/8 inch
3	12 "
2 empty	16 "
1 empty	16½ "

Nov. 6, 1958 -

Barrel No.	Down from Bung
1	9 3/4 inches
2	17 1/4 "
3	3 3/4 "

(Following this table is a sketch showing the first manhole downstream from No. 1-99.) Roots covered with asphalt which has apparently run through cracks and down roots.

(Note - locate pictures which refer to this particular situation. Also review the apparatus and method of taking pictures for possible inclusion in the report.) Second manhole downstream from manhole 1-99 - asphalt apparently oozing out of pin holes in bottom and along sides of manhole base. (Note - at this state of the development the fact that the sewer line had been raised a foot allowed a drain to build and a channel to build through which the asphalt could freely travel quite a distance without actually covering the sewer line and at this stage of development it was determined that quite considerable distances could be traveled over by the asphalt and its flow through a layer that would allow this type of flow.) Lots of roots in lines entering and leaving this manhole. This manhole is approximately 177 feet from point of application of asphalt.

April 9, 1959 - Sketch on this page shows the location of applicators upstream from manhole 1-99 to the cleanout. There are 10 applicators. No. 3 and 4 are marked duds. Lower half of line approximately 130 feet, was fairly dry 8 inches above line. Upper 135 feet was damp to muddy 8 inches above line. Procedure - April 9, 1959- morning: Applied SC-1 under approximately 55 p.s.i. to applicators starting at No. 1 to crack soil between applicator and sewer pipe.

1. Observations during pressure application at No. 1 applicator. This is shown on the sketch. 10:00 a.m. 60 p.s.i. put on applicator. Checked flow from barrel. Rapid entry of SC-1 to sewer line area. Approximately 1/2 inch flow in water in manhole 1-99.

2. Applicator 2, 10:15 a.m. 60 p.s.i. to applicator.

3. Applicator 3, 10:30 a.m. Oil blew out to street. M scope was haywire during line location giving rise to possibility of improper location of applicator.

4. Applicator No. 4, 10:45 a.m. on at 58 p.s.i. Broke through ok.

5. Applicator No. 5, 11:00 a.m. Broke at 58 p.s.i.

6. Applicator No. 6, on at 11:18 a.m. 63 p.s.i. broke through ok, taking oil rapidly.

7. Applicator No. 7, on at 11:27 a.m. Broke through ok.

8. Applicator No. 8, on at 11:37 a.m. Pressure at 66 p.s.i.

9. Applicator No. 9, on at 1:15 p.m. Pressure at 65 p.s.i. Broke through ok.

10. Applicator No. 10, installed on at 1:22 p.m. Pressure at 62 p.s.i. Broke through ok.

A total of 235 gallons of SC-1 used on the 265 feet of line given the primary treatment. (Note - at this stage of the game it was thought that 1 to 1½ gallons per lineal foot of sewer line was sufficient for treatment. That is one gallon of SC-1 and one of RS-1. However, it was later proved that this was an erroneous assumption because the amount of material to be used depended completely on the soil characteristics or the trench characteristics or the amount of bedding under the pipe or other variables, particularly imperveous nature of the soil around the pipe.) No. 1 applicator turned on at 10:20 a.m., 4¼ inches oil in bottom of drum at start of test. At 10:22 a.m. oil coming out top test cock at manhole No. 1-99. Valve in tank barely cracked to reduce flow to line. 10:30 a.m. oil coming out of side test cock in manhole 1-99. Oil shut off from tank. 12:35 p.m. SC-1 coming through manhole base as well as two upstream top cocks. 4-1/8 inches oil in bottom of drum. 1:06 p.m. tank put on No. 2 applicator. Applicator taking oil as fast as it runs out of tank. Oil under only approximately 2 inch head. Valve opened 1 turn at 1:08 p.m. 1:15 p.m. valve opened only 1/2 turn. At 1:35 p.m. valve opened full. Upper stop cock dropping one drop per 7 seconds. Feed pipe overflowing at tank at 1:43 p.m. Valve secured. Valve opened 2 turns, line overflowing. Valve opened 1/2 turn. 1:50 p.m. valve opened 1 full turn. 1:55 p.m. valve opened to 1½ turns. 1:57 p.m. valve opened to 2 turns. 1:58 p.m. overflow at tank. Valve cut to one full turn. Oil coming in to top stop cock at speed of 4 seconds per drop. 2:03 p.m. oil shut off to No. 2 applicator. 3-1/8 inches oil in bottom of drum. 2:08 p.m. drops in upper cock equal 10 seconds per drop. 2:15 p.m. drops 15 seconds per drop. 2:25 p.m. hooked tank to No. 4 applicator. No. 3 applicator blew out to street. No. 3 appeared to have been placed exactly on edge of trench. (There is a sketch showing the location of the applicator in split in the pavement.) 5½ inches oil in bottom of drum. 2:27 p.m. upper cock dropping out at rate of plus 1½ minutes. Tank about 1 turn of valve open. 2:38 p.m. 5-3/8 inches in tank. 2:45 p.m. filled barrel to 9-3/4 inches above bottom. This increased head of oil in applicator. More oil floating in sewage through manhole 1-99. 3:39 p.m. pressure again applied to applicator at 62 p.s.i. 3:40 p.m. traces of oil in sewage indicating leakage into line near point of application. 3:50 p.m. valve to tank wired open. Oil will be allowed to run overnight. Valves in manhole closed. They will be opened Friday morning to check for oil leakage to manhole 1-99. At 3:50 p.m. no perceptable leakage from upper stop cock. 125 gallons used in tanks as of 4 p.m.

April 13, 1959 - 1:00 p.m. No oil coming out of oil cocks in manhole 1-99. Drum empty at 10:00 a.m. This means that approximately 15 gallons went down to sewer between 4:00 p.m. Thursday, April 9 and this morning. Put 3½ inches oil above bung. At 1:00 p.m. 2½ inches oil remaining above bung. (Note - this upper reference to above bung probably means above bottom) Tank removed. No. 5 applicator hooked up at 1:20 p.m. 5-1/8 inches oil above bottom. Oil entered ground rapidly for four minutes then slowed down considerably.

No. 5 Applicator

1:35	4-1/8 inches
1:45	3-3/4 inches
2:00	3-1/2 inches
2:18	3-3/8 inches
3:20	3-1/8 inches

No. 6 applicator

2:50	4-1/2 inches
2:55	4-3/8 inches
3:05	4 inches
3:15	3-7/8 inches
3:25	3-5/8 inches
3:45	3-1/4 inches

No. 7 applicator

4:43	5-1/2 inches

April 14, 1959 - 9:15 a.m. - Barrel on No. 7 applicator empty. Manhole 1-99 shows slight amount of oil coming out around base where oil previously had entered. No. 8 applicator started at 9:40 a.m. 4-1/4 inches oil above bottom. 9:45 a.m. blobs of oil appearing on water at manhole 1-99 indicating leaks in sewer line adjacent to applicator.

9:50	4 inches
10:15	3-3/4 inches
10:43	3-1/2 inches
11:00	3-3/8 inches
11:15	3-1/4 inches
11:37	3-1/16 inches - tank removed

No. 9 applicator hooked up at 11:45 a.m. Oil measured at 5½ inches above bottom. 3/4 inch at 1:05 p.m. 5 gallons of water put in cleanout. Took 1 minutes 15 seconds to run down line. Considerable oil washed down line. No. 10 applicator attached 1:25 p.m. 2-3/4 inches above bottom 1¼ inch at 1:43 p.m. 3/4 inch at 1:45 p.m. Added oil at 1:50 p.m. Level at 3-3/4 inches. Considerable oil in sewer line at manhole 1-99 indicating leakage in this area of line where oil being applied. 2-3/4 at 2:02 p.m. Flushed 5 gallons water through line. 2-3/8 inches at 2:15 p.m. 2 inches at 2:20 p.m. 1½ inches at 2:28 p.m. 5/8 inch at 2:45 p.m. Applicator removed.

April 15, 1959 - Manhole 1-99 shows no appreciable oil leakage through manhole base.

April 17, 1959 - 5-1/8 inches RS-1 in No. 2 applicator at 9:33 a.m. Approximately 50 gallons flushed through line from cleanout at end of line. 9:45 a.m. considerable RS-1 entering sewer line. 4½ inches at 9:52 a.m. 4-7/16 at 10:15 a.m. 4 inches at 10:33 a.m. No. 1 tank 5-5/8 inches RS-1. Turned on at 1:05 p.m. 5 inches at 1:10 p.m. 1:15 p.m. RS-1 out top stop cock turned valve off to 1/2 turn open. 1:17 p.m. RS-1 out lower stop cock. Tank valve turned off at 1:20 p.m. 1:27 p.m. RS-1 coming out base of manhole 1-99. No. 2 applicator 3-3/4 inches at 11:10 a.m. 3-1/2 inches 11:25 a.m. 3-1/4 - 11:50 a.m. 2-1/8 - 1:00 p.m. 1-1/2 - 1:25 p.m. 7/8 at 1:46 p.m. 7/8 at 2:10 p.m. Drum removed. No. 4 applicator:

5-7/8 inches	1:08 p.m.
4-5/8 inches	1:25 p.m.
4-9/16 inches	1:47 p.m.

2:00 p.m. RS-1 running in very slowly. 4-7/16 at 2:25 p.m. Removed applicator. Tank replaced at 3:37 p.m. 4-1/8 inches at 3:37 p.m. No. 1 applicator 4-1/8 inches at 1:45 p.m.

No. 5 applicator 6 inches at 2:05 p.m.
5½ " " 2:25 "
5 " " 2:40 "
5 " " 2:52 "

Removed tank.

No. 6 applicator 5½ inches at 2:23 p.m.
4-5/16 " " 2:42 "
2-7/8 " " 3:12 "

Tank removed.

No. 7 applicator 4-3/8 inches at 2:38 p.m.
1-1/2 " " 3:00 "

Tank removed

No. 8 applicator 5 inches at 3:00 p.m.
4-1/8 " " 3:17 "
3-5/8 " " 3:40 "

Tank removed

No. 9 applicator 4-5/8 inches at 3:10 p.m.
4 " " 3:19 "
0 " " 4:00 p.m.

Tank removed.

No. 10 applicator 3-1/8 inches at 3:17 p.m.
1 " " 3:28 p.m.

Tank removed

Approximately 1 gallon solidified RS-1 removed from manhole at 3:55 p.m.

Monday, April 20, 1959 - 130 gallons RS-1 used Friday. Line flushed out. Quite a bit of SC-1 flushing through base of manhole 1-99 and two stop cocks plugged up with RS-1. No. 1 applicator which was left barely moving empty. 4-1/8 inches RS-1 in ground over weekend. No. 1 drum put back on line 4-7/8 inches at 9:48 a.m. 4-3/8 inches at 10:45 a.m. Tank removed.

No. 2 applicator 6-5/8 inches at 9:40 a.m.
6-1/8 " " 9:47 a.m.
5-7/8 " 10:37 a.m.
5-5/8 " 11:08 a.m.

Tank removed

No. 4 3-7/8 inches oil at 9:55 a.m. This was 4-1/8 inches on Friday afternoon 4/17/59. Tank removed.

No. 5, No. 6 and No. 7 applicators are blank.

No. 8 applicator 5-1/4 inches at 11:25 a.m. Open 1-1/2 turns. 4-7/8 inches at 11:50 a.m. open 2 turns. Opened valve wide at 11:55 a.m. 4-5/8 inches at 1:10 p.m. Valve wide open. 4-1/2 inches at 1:42 p.m. 4-7/8 inches at 2:00 p.m. 4-3/4 inches at 2:24 p.m.

No. 9 applicator - 4-1/4 inches at 10:50 a.m. Open 1-1/2 turns.
4 11:26 a.m.
3-7/8 11:46 a.m. Open to 2 turns
3-1/4 1:10 p.m. Valve open wide
3 1:40 p.m. RS-1 added
5-1/2 1:58 p.m.
5-1/4 2:25 p.m.

No. 10 applicator 3-1/4 inches at 10:08 a.m. Valve opened only 3/4 turn
3-1/4 inches 10:45 a.m. Valve open to 1-1/4 turns
2-7/8 inches 11:25 a.m.
2-3/8 11:45 a.m.
1-3/8 1:15 p.m. Valve opened wide
1-1/8 1:38 p.m.

No. 10 applicator (contd) 5-1/4 2:25 p.m.

5 2:51 p.m.

7 3:42 p.m. Tank valve closed overnight by accident

Tank filled

Valve opened at 9:15 a.m. 4/21/59

No. 9 applicator (contd)

5 inches at 2:52 p.m. Tank filled

7 3:40 p.m.

3-1/2 9:15 a.m. 4/21/59 - 3-1/2 inches oil used overnight

No. 8 applicator (contd)

4-5/8 inches at 2:53 p.m. Filled

7 3:39 p.m.

6 9:15 a.m. 4/21/59 - Down 1 inch - Tank removed

(This finished Volumelof the EBD notes)

E. B. Dykes Notes - Volume 2

April 21, 1959 - Flushed lines. Got one piece of RS-1 about half size of a fist from the line. 110 gallons RS-1 left in tank. 90 gallons of RS-1 used 4/21/59.

No. 6 applicator 3-1/2 inches 10:10 a.m.

3-3/8 10:22 a.m. Oil added to tank

7-1/8 10:32 a.m.

7 11:14 a.m.

7 1:05 p.m.

7 1:40 p.m.

7 2:02 p.m.

6-15/16 2:43 p.m.

6-15/16 3:20 p.m.

No. 7 applicator	7 inches at	10:12 a.m.	
	6-1/8	10:35 a.m.	
	5-1/8	11:12 a.m.	
	2-3/8	1:05 p.m.	Valve cut down to 1-1/2 turns open at 1:08 p.m.
	2-1/8	1:38 p.m.	
	2	2:05 p.m.	Tank filled
	7-1/2	2:10 p.m.	
	7-3/8	2:40 p.m.	Tank shut off
No. 5 applicator	7 inches at	11:53 a.m.	
	6-3/4	1:03 p.m.	
	6-3/4	1:42 p.m.	
	6-1/2	2:05 p.m.	
	6-1/2	2:45 p.m.	
	6-1/2	3:20 p.m.	

No. 10 applicator (contd)

7 inches at	9:15 a.m.	
6-7/8	10:38 a.m.	
6-13/16	11:10 a.m.	Tank removed

No. 7 (contd) - Valve shut off at 3:00 p.m. to attempt to set up RS-1 in large openings in line. 3:20 p.m. 1-1/2 turns open. 7-3/8 at 2:40 p.m. 7-3/8 at 3:55 p.m.

April 21, 1959 General: There are four houses connected to the line under test. Roger also states that there are two house services to vacant lots. All of these six house services are probably taking in water although one is a transite line inspected by Roger. As only three of the remaining five could be readily found it was decided not to treat the house services at this time. 1:15 p.m. RS-1 coming into manhole. Piece 2/3 gallon in size coming through. Total RS-1 to 4:10 p.m. (4/21/59) retrieved from manhole 1-99 equals 2 gallons.

April 22, 1959, Wednesday - About 1 quart of solid RS-1 removed from manhole 1-99 at 9:15 a.m. 80 gallons RS-1 left in supply tank. No. 5 applicator had 6-1/2 inches in on 4/21/59 p.m.

4/22/59 a.m. 5-7/8 inches at 9:40 a.m.
5-3/4 " " 11:03 a.m.
5-3/4 " " 1:05 p.m.
5-11/16 " " 2:35 p.m.
4/22/59 5-3/4 inches at 3:35 p.m.
5-5/8 " " 11:15 a.m. 4/23/59
5-5/8 " " 1:16 p.m. Tank removed

No. 6 applicator - 4/22/59
6-15/16 inches at 4/21/59 p.m.
6-15/16 inches at 9:40 a.m. 4/22/59 - No oil entered ground overnight
6-15/16 inches at 9:15 a.m.
4/23/59 - Tank removed

No. 7 applicator - 4/22/59 (had 7-3/8 inches at 4/21/59 p.m.)
7 inches at 9:45 a.m. 4/22/59
Valve was opened 1¼ turns. Valve open to two turns at 9:45 a.m.
6-13/16 inches at 10:20 a.m. - Valve closed to 1½ turns
6-3/4 inches at 11:00 a.m. - Open to two turns

No. 9 applicator - 4/22/59 Tank installed at 10:00 a.m. 7-3/8 at 10:05 a.m.
7-1/16 10:48 a.m.
7-1/4 1:00 p.m.

Tank removed at 1:10 p.m.

No. 7 applicator (contd) 4/22/59	6-3/4 inches	11:00 a.m. - valve opened to two turns
	6-5/8 "	11:15 a.m. - Valve opened wide
	5-3/4 "	1:00 p.m.
	5-1/2 "	1:45 p.m. Valve closed to one turn-Open to see if leak is from this barrel.
	5-1/2 "	2:40 p.m. Opened to two turns
	5-1/8 "	3:00 p.m. Valve shut off as lots of RS-1 in line. Time of closure is 3:16 p.m.
	5 "	4:00 p.m.
	4 "	9:20 a.m. 4/23/59
	3-1/2 "	1:20 p.m. Tank shut off after giving tank flush to throw water to top of line. Time 1:30 p.m.
No. 2 applicator 4/23/59	7 inches	9:50 a.m.
	6-3/4 "	11:00 a.m.
	6-1/2 "	12:01 p.m.
	6 "	1:10 p.m. Tank turned off at 1:15 p.m.
	5-5/8 "	3:53 p.m. Valve open to 1-1/4 turns
4/24/59	5-3/4 "	9:20 a.m.
	5-1/2 "	11:55 a.m.
	5-3/8 "	1:12 p.m.
No. 8 applicator 4/22/59	6-3/4 inches	1:18 p.m.
	6-3/4 "	1:45 "
	6-3/4 "	2:40 "
	6-3/4 "	2:45 "
	6-5/8 "	3:40 "

1:37 p.m. 4/22/59 RS-1 showing up in manhole 1-99.

No. 2 applicator (contd) 4/24/59

5-1/4 inches at 2:55 p.m.

5 " 3:55 p.m. Valve left 1-1/2 open over weekend

0 " 10:00 a.m. 4/27/59 .

No. 7 applicator (contd) 4/23/59

3-1/2 inches at 1:20 p.m.

At 2:50 p.m. valve opened 1-1/2 turns RS-1 still coming in line

3:12 p.m. valve opened wide

3:25 p.m. valve secured - lots of RS-1 in line

3:47 p.m. valve opened 1-1/4 turn

7-7/8 inches at 4:10 p.m.

5-1/2 " " 9:25 a.m. (4/24/59)

5-1/2 " " 10:25 a.m.

5-3/8 " " 11:25 a.m.

5-5/16 " " 11:55 a.m.

5 " " 1:15 p.m. Tank secured

4/23/59 - At Station 0+65 exposed at No. 3 applicator. (Note - two sketches one shows the top of the pipe at 34 inches below grade and the other shows both SC-1 and RS-1 around pipe from spring line down.) Nearest applicator is 60 feet upstream. This being No. 5 applicator. Applicator put in along side pipe. 7½ inches at 4:00 p.m. Opened valve 2 turns 7-1/8 inches at 9:20 a.m. 4/24/59. 1:10 p.m. lots of RS-1 coming down line from No. 7 barrel. House service to 55 Arroyo Avenue (Rosehaven) excavated to check pipe joint. Ground very wet around pipe. Lots of roots entering joints.

Monday, April 27, 1959 - No. 2 applicator took 5 inches of RS-1 over weekend. No sign of RS-1 in manhole 1-99. Plant received no RS-1 so all of it must have gone into ground. Valve turned on 1-1/2 turns at 11:50 a.m.

7-9/16 inches at 11:50 a.m.
7-1/8 " " 1:08 p.m.
7 " " 2:05 p.m.

Checked manhole 99 at 1:10 p.m. SC-1 in water but no RS-1.

No. 2 applicator (contd)

7 inches at 2:45 p.m.
7-1/2 inches at 3:50 p.m.
7-1/2 inches at 9:15 a.m.

4/28/59 - Irum removed

No. 7 applicator

5 inches at 10:45 a.m. Turned on at this time.
4-7/8 inches at 11:38 a.m.

Note - at 11:15 a.m. manhole 1-99 was checked to see if any RS-1 was coming into the sewer line but none was apparent at that time. 4-3/8 inches at 1:05 p.m. Valve open wide.

No. 7 applicator (contd)

4-3/4 inches at 2:08 p.m.
4-11/16 " " 3:26 p.m.
4-11/16 " " 3:56 p.m.
0 " " 9:15 a.m. 4/28/59 - Added more RS-1
4-3/8 " " 9:40 a.m. RS-1 entering manhole 1-99 at 10:00 a.m.
Valve closed

(Note - the method of measuring the level of RS-1 and SC-1 in drums was made with a dip stick. The drums were mounted on 2x4 frames so that any shifting of the drums or any possible misplacing of the dip stick in the drum could result in a higher reading than previous readings and for this reason question marks will appear at some of these higher readings. However, if the position of the drum was changed then all the subsequent readings will, of course, be referred to the higher or changed reading and that's why they were left in these notes rather than being corrected or discarded.)

4/27/59 - (There is a sketch showing house services A, B, C, D, E and one transite house service which was not treated.) At A treatment with SC-1.

6-5/8 inches at 2:13 p.m.
5 " " 2:55 "
4-5/8 " " 3:25 p.m.
4-3/8 " " 3:55 p.m.
0 " " 9:15 a.m. 4/28/59
8 " " 11:16 a.m. RS-1 added
7-7/8 " " 11:38 a.m.
6-1/4 " " 1:05 p.m.
5-3/4 " " 2:20 p.m. Throttle to one turn
5-3/4 " " 3:30 p.m.
5-5/8 " " 3:55 p.m. Valve open to 1-1/8 turn

Wed., April 29, 1959

5-3/8 " " 9:40 a.m.
5 " " 10:53 a.m. Valve open to 1-1/2 turns
4-3/4 " " 11:40 a.m.
3-5/8 " " 1:20 p.m.
3-5/8 " " 2:21 p.m. Cut to one turn
2-3/4 " " 3:32 p.m.
0 " " 9:17 4/30/59

House Service B - SC-1

5 inches at 2:17 p.m.

3-5/8 " " 3:01 p.m.

3-1/8 " " 3:26 p.m.

2-5/8 " " 3:58 p.m.

0 " " 9:15 a.m. 4/28/59 - RS-1 added

5-3/8 " " 11:39 a.m.

5-1/8 " " 1:05 p.m.

5-1/8 " " 2:25 p.m.

5 " " 3:35 p.m.

Wed. 4/29/59 - RS-1 coming out of ground around applicator

3-1/4 inches at 9:45 a.m.

Valve opened 1-1/4 turns

3-1/2 inches at 10:58 a.m.

3-5/8 " " 11:44 (tank heating up)

3-5/8 " " 1:25 p.m.

3-5/8 " " 2:25 p.m.

3-1/2 " " 3:40 p.m. Valve shut off

3-3/8 " " 9:22 a.m. 4/30/59 - tank removed

House Service C - SC-1

6-3/8 inches at 2:20 p.m.

6-1/8 " " 3:05 p.m.

5-13/16 " " 3:30 p.m.

5-3/8 " " 4:00 p.m.

0 " " 9:15 a.m. 4/28/59 - RS-1 added

6 " " 11:43 a.m.

	5-3/4	inches	at	1:05 p.m.
	5-5/8	"	"	2:26 p.m.
	5-3/8	"	"	3:40 p.m.
	0	"	"	9:47 a.m. 4/29/59
RS-1 added to tank	4-7/8	"	"	10:28 a.m. Valve opened 1-1/2 turns
	4-13/16	"	"	11:00 a.m.
	4-13/16	"	"	11:45 a.m.
	4-1/4	"	"	1:25 p.m.
	4-1/2	"	"	2:27 p.m. Valve opened 1-3/4 turns
	4-3/8	"	"	3:40 p.m.
	0	"	"	9:25 a.m. 4/30/59

House Service D- SC-1

	6-5/8	inches	at	2:15 p.m.
	6-1/4	"	"	3:00 p.m.
	6	"	"	3:27 p.m.
	5-3/4	"	"	4:00 p.m.
	1-3/8	"	"	9:15 a.m. 4/28/59
RS-1 added	6-3/8	"	"	11:15 a.m.
	6-1/4	"	"	11:35 a.m.
	6-1/4	"	"	1:05 p.m.
	6-1/8	"	"	2:21 p.m.
	5-5/8	"	"	3:33 p.m.
	6-1/8	"	"	9:45 a.m. 4/29/59
	6-1/8	"	"	10:55 a.m.
	6-1/8	"	"	11:42 a.m.
	6-1/8	"	"	1:25 p.m.
	6-1/8	"	"	2:25 p.m.

60 pounds pressure put on applicator to try and break set up RS-1 loose at 2:50 p.m.

Valve open 1 + turns.

6-1/8 inches at 3:35 p.m.

5-3/8 " " 9:20 a.m. 4/30/59

House Service E - SC-1

6-5/8 inches at 2:24 p.m.

5 " " 3:05 p.m.

4-5/8 " " 3:25 p.m.

4 " " 4:02 p.m.

0 " " 9:15 a.m. 4/28/59

RS-1 added 4-1/2 " " 10:55 a.m.

4-1/4 " " 11:00 a.m.

2-3/4 " " 11:32 a.m.

Valve cut down to one turn

2-1/2 " " 1:05 p.m.

2-7/16 " " 2:27 p.m.

Open valve to 1-1/4 turns

RS-1 added to tank 5-3/4 " " 3:15 p.m.

5-5/8 " " 3:28 p.m.

5-1/8 " " 9:15 a.m. 4/29/59

Valve open to two turns

5-1/4 " " 11:03 a.m.

Barrel very hot (liquid expands)

5-1/8 " " 1:30 p.m.

4-3/8 " " 9:25 a.m. 4/30/59

On 4/27/59 house service applicators at 2:35 p.m. lots of SC-1 in manhole after house service application.

Tuesday, 4/28/59 - Walt got another 90 gallons of RS-1. No. 7 applicator turned on at 2:45 p.m. 4/28/59.

4 inches at 2:45 p.m. on 1-1/4 turns
3-7/8 " " 3:08 p.m.

Shut off at 3:21 p.m.

4/29/59 3-5/8 " " 10:55 a.m.

Valve open to try and fill pipe. 10:05 valve turned off.

House service E (contd) 4/29/59

5-7/8 inches at 2:30 p.m.
5-7/8 " " 3:42 p.m.
4/30/59 4-3/8 " " 9:25 a.m.
4-1/4 " " 1:35 p.m.
4-1/8 " " 3:45 p.m.
2-7/8 " " 9:05 a.m. 5/1/59
2-1/8 " " 2:03 p.m.
No. 7 (continued) 3-5/8 " " 3:38 p.m. Valve closed
3-1/2 " " 9:32 a.m. 4/30/59

5/1/59 - Applicator taking very little RS-1 or water. Leak in main line apparently plugged.

2-7/8 " " 2:22 p.m. Tank removed

House Service C (contd)

3-3/8 " " 9:45 a.m. 4/30/50 - Valve barely opened.

Valve shut off at 11:45 a.m. preparatory to blocking leak.

3-1/4 " " 1:30 p.m.

(There follows a sketch dated 5/1/59 showing a house service applicator. The 5 foot 7 inch length of run of RS-1 to the end of the pipe.)

House Service D (contd)

4/30/59 5/8 inches at 9:20 a.m. Valve opened wide
5-1/4 " " 1:27 p.m.
5-1/8 " " 3:45 p.m.
5-1/8 " " 9:00 a.m. 5/1/59 Tank removed

House Service A (contd)

4/30/59 3-7/8 inches at 9:45 a.m.
3 " " 1:25 p.m.
3 " " 9:15 a.m. 5/1/58
1-5/8 " " 2:10 p.m.

5/1/59 - House service C - House service excavated to spring line of pipe. Water put in ditch over pipe at 2:00 p.m. None apparently sinking into pipe bedding.

5/5/59 - No. 8 applicator dug up along with approximately 5 feet of main line. House Service A RS-1 hooked up to applicator.

Treating as follows:

1. Applicator flushed with fresh water.
2. Half gallon water plus 2 tablespoons salt (sodium chloride) added to applicator.
3. Drained applicator for 19 minutes and turned on RS-1 from drum. 11½ inches RS-1 in barrel. 10½ inches at 3:32 p.m. 10-7/16 at 3:55 p.m. Valve shut off at 4:00 p.m.

5/6/59 - 10 inches at 3:35 p.m.

Recap - 265 feet of 6 inch main line. 100 feet of 4 inch house service. Total SC-1 used equals 235 gallons. Total RS-1 used equals 345 gallons plus estimated 50 gallons retrieved from manhole 1-99. Board of Supervisors checked excavation 5/11/59.

Following is a list of the original calculations for the total amount of mileage to be sealed in the three local improvement districts.

L.I.D. 1	14.486 miles
L.I.D. 2	10.163 miles
L.I.D. 3	0.748 miles
	25.397 miles total

With approximately 25½ miles of sewer line in the three districts plus 10½ miles of trunk lines to be treated the total is approximately 36 miles representing the first estimate of the total amount of lines to be treated.

End of Volume 2 of the EBD Notes

Volume 3 - (On March 16, 1959 at Station 0+14 is a sketch showing asphalt under pipe and around joints where joints evidently leaked. At joint 0+06 asphalt completely around pipe. Another sketch which shows manhole 1-99 water leaking inside of trench near manhole 1-99. Approximately 2 feet of barrier preventing flow of water along pipe a section of that sketch showing asphalt up to the spring line of the pipe. Then slight water leakage from side of ditch and the rest of the ditch is dry downstream from the manhole. At Station 0+26 on 3/18/59 another little sketch showing asphalt around bell and along side pipe at 0+36. Gravel strata under pipe took asphalt. Sketch here shows the gravel strata about 2 feet wide and 1 foot deep. Pipe grade evidently raised about 1 foot by bedding pipe on gravel. This gravel has taken large quantities of asphalt.)

Sealing tests on lines tributary to Arroyo.

7/31/59 - Central Avenue - 10:35 a.m., applicator No. 2 hit with 70 p.s.i. SC-1, pressure dropped to 58 p.s.i. 10:45 - turned on oil by gravity. Oil leaking freely through pipe joints. Twenty gallons added prior to 12 noon. 1:10 p.m. no oil in manhole 1-94. Will add 15 gallons SC-1 to those drums which are hooked up.

8/3/59 - 1:20 p.m., manhole 1-94 signs of SC-1 through bottom. Following applicators are upstream from manhole 1-94. No. 1 two feet upstream from manhole 1-94. No. 2 total of 25 gallons added up to 1:15 p.m.

7/31/59 - 1:50 p.m., Oil welling up between cracks in clay pipe in manhole 1-94. Empty 8/9/59. No. 3 applicator opened at 60 p.s.i., 15 gallons added. 1:45 p.m., oil turned on 2:45 p.m. Fifteen gallons in at 3:50 p.m. on 8/31/59/ Empty 8/4/59. No. 4, 15 gallons in at 3:53 p.m. 8/3/59. 11:45 a.m. still oil in drum. No. 5, fifteen gallons in at 4:00 p.m. Empty at 11:45 a.m. 8/4/59. No. 6, fifteen gallons SC-1. No. 7, fifteen gallons SC-1. No. 8, fifteen gallons SC-1. No. 9, fifteen gallons SC-1. No. 10, fifteen gallons SC-1. No. 11, added fifteen gallons SC-1. No. 12, added fifteen gallons SC-1 to drum at 2:00 p.m., 7/31/59. 70 p.s.i. at 3:30 p.m. Valve opened 3:35 p.m. Empty at 10:00 a.m. on 8/6/59. No. 13, fifteen gallons SC-1 added at 2:05 p.m., 7/31/59. 60 p.s.i. at 3:35 p.m. Valve opened at 3:37 p.m. Empty at 11:47 a.m. 8/4/59. No. 14, fifteen gallons at 2:50 p.m., 7/31/59. 62 p.s.i. at 3:40 p.m. Drum on at 3:45 p.m. Empty at 11:47 a.m., 8/4/59. No. 15, fifteen gallons SC-1 in drum at 3:10 p.m. 56 p.s.i. at 3:45 p.m. Drum on at 3:50 p.m. Empty at 11:50 a.m. 8/4/59. No. 16, 8/4/59 no oil entering ground. 8/6/59, no oil entering ground after 80 p.s.i. Drum removed and attached to applicator No. 17. No. 17, 8/3/59, 15 gallons added Monday a.m. No oil to ground on 8/4/59. 70 p.s.i. at 1:50 p.m. 8/4/59. 8/6/59, No. 16 drum added to this applicator. 6-3/4 inches at 10:00 a.m. 8/6/59. Estimate + 5 gallons SC-1. Total 20 gallons SC-1. No. 18, fifteen gallons SC-1 added 8/3/59 a.m. No oil entering ground on 8/4/59. Drum removed and put on No. 19 applicator. 0 gallons SC-1. No. 19, fifteen gallons added 8/3/59 a.m. Not taking oil on 8/4/59. 72 p.s.i. at 1:40 p.m. Tank opened again at 1:40 p.m. Oil from No. 18 applicator put on line at 10:00 a.m. 8/6/59. 4-3/4 inches oil. Estimate + 5 gallons SC-1. Total 20 gallons SC-1. No. 20, fifteen gallons at 8/3/59, a.m.

Aug. 10, 1959 - No. 1 applicator turned on at 10:10 a.m. 10:35 a.m. throttled tank as RS-1 coming through base of manhole 1-94. Added 5 more gallons to No. 1.

Aug. 11, 1959 - 9:00 a.m. Total 20 gallons RS-1. Applicator No. 2, 8/10/59, 9:15 a.m. turned RS-1 on. Fifteen gallons in barrel. 9:45 empty. 8/11/59 at 9:40 a.m. 16½ inches RS-1. Turned on slow. RS-1 breaking through manhole 1-94 base so secured this drum at 9:53 a.m. Total 20 gallons oil. Applicator No. 3, 8/10/59 at 1:10 p.m. Opened RS-1 to applicator. Opened 1/2 turn. 8/11/59. 8:53 a.m. drum nearly empty. Total 15 gallons RS-1. No. 4, 8/11/59 valve opened with RS-1 at 9:15 a.m. Total 15 gallons RS-1. No. 5, 8/11/59 RS-1 on at 9:15 a.m. On slow. Total 15 gallons RS-1. 8/11/59 RS-1 on at 9:16 a.m. on slow. Total 15 gallons RS-1. No. 7, 8/11/59 RS-1 on at 9:20 a.m. - on slow. Total 15 gallons RS-1. No. 9, 8/11/59 on slow at 10:10 a.m. Total 15 gallons RS-1. No. 10, 8/11/59 RS-1 on slow at 10:12 a.m. Total 15 gallons RS-1. No. 11, 8/11/59 RS-1 on slow at 10:13 a.m. (There follows a sketch which shows Day's house and a corrugated metal pipe crossing between applicators No. 12 and No. 11) Total 15 gallons RS-1. (Note - this reference to corrugated metal pipe at Day's house will have significance later on.) No. 12, 8/11/59 RS-1 on slow at 10:15 a.m. This applicator upstream from corrugated metal pipe in front of Day's house. Fifteen gallons total RS-1. No. 13, 8/11/59 RS-1 on slow at 10:20 a.m. Fifteen gallons total RS-1. No. 14, 8/11/59 RS-1 on slow at 10:45 a.m. Thirty gallons RS-1. No. 15, 8/11/59 RS-1 on slow at 10:47 a.m. Total 15 gallons RS-1. No. 16, line never opened. No RS-1 to the applicator. 0 gallons RS-1. No. 17, 8/11/59 RS-1 added slow at 10:53 a.m. 30 gallons RS-1 added through this applicator. 30 gallons RS-1 total. No. 18, 8/11/59 RS-1 on slow at 11:00 a.m. 0 gallons added. No. 19, 8/11/59 RS-1 on slow at 11:05 a.m. 12½ gallons RS-1 added to this applicator. Total 12½ gallons RS-1. No. 20, 8/11/59 RS-1 on slow at 11:05 a.m. 8/13/59, 10:20 a.m. 2½ gallons left in drum. Another drum attached to put more RS-1 in applicator. Total 15 gallons RS-1. No. 21, 8/17/59

Cracked with SC-1 at 71 p.s.i. Cracked valve at 1:54 p.m. 15 gallons SC-1 in tank. Fifteen gallons RS-1 on 9:50 a.m. 8/17/59. Empty on 8/20/59. House service near No. 21, fifteen gallons RS-1 empty 8/20/59. No. 22, 8/17/59 broke at 2:01 p.m. at 67 p.s.i. Drum on applicator with valve cracked. 15 gallons SC-1. 8/19/59, 15 gallons RS-1 on at 10:05 a.m. Empty 8/20/59. No. 23, 8/17/59, broke at 2:10 p.m. at 64 p.s.i. Fifteen gallons SC-1, valve cracked open. Thirty gallons total SC-1 in this applicator, 8/19/59. 15 gallons RS-1 in at 10:05 a.m., 8/19/59. Running slow 8/20/59 and 8/21/59. Total 15 gallons RS-1, 30 gallons SC01. No. 24, 8/17.59, broke at 2:15 p.m. at 62 p.s.i. 15 gallons SC-1. No go, drum removed on 8/18/59. No. SC-1, no RS-1. No. 25, 8/17/59, broke at 2:20 p.m. 70 p.s.i. drum on. Thirty gallons RS-1 put in at 10:07 a.m. 8/19/59. Empty 8/20/59. No. 26, 8/17/59, broke at 2:27 p.m. at 67 p.s.i., 15 gallons SC-1. 15 gallons RS-1 on at 10:16 a.m. 8/19/59. Empty at 1:27 p.m., 8/19/59. Total RS-1 15 gallons. No. 27, 8/17/59, broke at 2:32 p.m. at 65 p.s.i. 15 gallons SC-1. RS-1 on at 10:28 a.m., 8/19/59. Empty at 1:40 p.m. Total RS-1 = 15 gallons.

House service at the grey house with the pink trim. SC-1 on at 2:35 p.m. 15 gallons RS-1 8/19/59, on at 1:30 p.m. Running slow 8/20/59 and 8/21/59. Total RS-1 equals 15 gallons.

No. 28, 8/17/59, broke at 2:40 p.m. at 64 p.s.i. 15 gallons RS-1 on at 10:40 a.m., 8/19/59. Empty 8/20/59, total RS-1 equals 15 gallons.

No. 29, 8/17/59, broke at 2:45 p.m. at 63 p.s.i. 15 gallons SC-1. 15 gallons RS-1 on at 10:45 a.m. 8/19/59. Empty 8/20/59, total RS-1 equals 15 gallons.

House service last home to the right upstream turned on at 2:40 p.m., 8/17/59. On RS-1 15 gallons, 8/20/59. Running slow 8/20/59 and 8/21/59. Total RS-1 15 gallons. 8/17/59, house service next to last house on left side of street facing upstream on at

2:50 p.m., 30 gallons SC-1 added to the applicator. 30 gallons RS-1 in at 8/19/59. On line at 1:45 p.m. 19½ gallons left in drum as 12½ gallons transferred to No. 30 applicator. Total RS-1 equals 19½ gallons.

No. 30, 8/17/59, shallow applicator no pressure applied to it. On at 2:15 p.m., 40 gallons total SC-1 put in this applicator. 15 gallons RS-1 on at 10:50 a.m., 8/19/59. Total 27½ gallons RS-1.

House services between manhole 1-94 and upstream cleanout - 8/25/59 left first house service (Castellani) fifteen gallons RS-1. Second house service (Comelli) 0 gallons RS-1. Third house service (Davis) 0 gallons RS-1. Right - first house service owned by Day 15 gallons RS-1. Second house service (Day) 15 gallons RS-1. No. RS-1 removed from manhole 1-94 during this operation. Between manhole 1-93 and 1-94, 8/24/59, following are 13 applicators and the amount of SC-1 each one took.

No. 1 - 15 gallons
2 - 0
3 - 15
4 - 15
5 - 15
6 - 15
7 - 15
8 - 15 gallons
9 - 15
10 - 0
11 - 0
12 - 45
13 - 15

E. B. Dykes Notes - Volume 3

8/26/59 - Total SC-1 to date applicators No. 1 through No. 13 equals 180 gallons SC-1. Note - very little SC-1 showing up in manhole 1-93. Either the line is fairly tight or gravel or other pockets below that take SC-1 to the extent that level stays below pipe. (There follows a sketch of the possible condition showing SC-1 below the elevation of pipe.)

8/26/59 - Both house services on left of street looking upstream took 15 gallons SC-1 apiece, but house service on right hand side of street is a dud. RS-1 turned on in following applicators.

No. 1	9:35 a.m.	60 gallons
2	dead	
3	9:40 a.m.	0
4	9:45 a.m.	75
5	9:50 a.m.	75
6	9:52 a.m.	30
7	9:55 a.m.	30
8	10:00 a.m.	15
9	10:05 a.m.	60
10	dead	0
11	dead	0
12	10:08 a.m.	85
13	10:10 a.m.	60

8/27/59 - House Services: RS-1 one left, on at 1:07 p.m. 15 gallons
two left, on at 1:20 p.m. 0 gallons
one right, on at 1:55 p.m. 0 gallons

(On the page following is a sketch showing Verde Vista manhole No. 1-92 and Manhole 1-93 with house service left and right. At manhole 1-93 is a house service that goes under the creek over to Central Avenue.)

1 right, 15 gallons SC-1, 15 gallons RS-1
1 left, 15 gallons SC-1, 2 gallons RS-1

There are 18 applicators listed, as follows:

Applicator No.	RS-1 (gallon)	SC-1 (gallon)
1	15	8
2	15	15
3	15	5
4	15	0
5	0	0
6	30	23
7	15	15
8	30	30 -upstream from creek
9	15	15
10	15	15
11	15	25
12	15	30
13	20	15
14	15	25
15	15	15
16	15	15
17	15	5
18	15	25

(Another sketch shows the line between 1-93 and the cleanout which would be the house service cleanout. At the cleanout 25 gallons RS-1, 30 gallons SC-1. In the creek downstream from the cleanout 15 gallons SC-1, 15 gallons RS-1. Further downstream, closer to manhole 1-93 (on the edge of the creek) 15 SC-1, 15 gallons RS-1. Near the manhole 1-93, 23 gallons RS-1. Five gallons solid RS-1 removed from this line. On the page following is a sketch showing Verde Vista from the cleanout to manhole 1-91 then down Arroyo from 1-91 to 1-92 to 1-99 with applicators. Following that is another table of applicators 1 through 6 each of which has 15 gallons SC-1 for the six applicators on Arroyo and although it is not listed it is assumed that there is also 15 gallons of RS-1 in each one of these applicators. Photographs in our files will substantiate these figures for the amounts of RS-1 because these photographs show that between manhole 1-92 and 1-99 the line has been raised about a foot allowing an extra foot of gravel below the pipe. On the next page is the recap of the total amounts of SC-1 and RS-1 used on Verde Vista (by Larson's) using 15 applicators.)

Applicator No.	RS-1 (gallon)	SC-1 (gallon)
1	15	15
2	15	15
3	15	15
4	15	12
5	15	15
6	13	82
7	15	85
8	15	50
9	15	82
10	15	95
11	15	60
12	15	15
13	15	7
14	15	23
15	0	0

(These figures are a recap of figures that are listed further on in Book No. 4. The indication of the larger uses of RS-1 for example, 82 and 85 and 95, indicate that at this stage of the game the addition of RS-1 was continued and by continuing adding RS-1 it indicated that there must have been some strata that would allow a lot of flow of asphalt or there was some pretty good sized holes because none of the asphalt was showing up in the line which indicated it was going some place and it certainly wasn't going down the line.) House services on Verde Vista

1 right - 15 gallons SC-1, 15 gallons RS-1
2 left - 25 gallons SC-1, 10 gallons RS-1
3 left - 3 gallons SC-1, 8 gallons RS-1

8/7/59 - At manhole 1-94 + cleanout for number 796 El Giadora is transite and 3.5 feet to top of pipe at property line. Note - at this stage of the operation the first attempts were made to drill with rotary drill using the air compressor and an air drill.

End of Volume 3

Volume 4 - E. B. Dykes Notes

Friday, Sept. 18, 1959 - Heavy rainfall this date caused ditch crossing Central Avenue between manhole 1-94 and cleanout 1-94 and ditch across Central Avenue north to Verde Vista to flow. Water showed up in manhole 1-94. Storm drain in front of day's house blocked at both ends (9/21/59) and filled with dyed water. This dyed water showed up in manhole 1-94 indicating bad leakage between storm drain and sewer.

9/22/59 - Sewer exposed at storm drain to ascertain cause of leakage. Note - sewer line is approximately 18 inches from were applicators installed. M scope not locating sewer too well for some reason. Four joints of pipe exposed. There was a tick layer of asphalt under the pipe and around the exposed joints. Ground water covered pipe but there was no apparent leakage in these exposed joints. Dye placed in water entered sewer line after a wait of some time. But this leakage must be downstream from excavated area.

Central Avenue - 9/28/59 - (Sketch shows 10 applicators with a sump in the line) 15 gallons SC-1 in all 10 applicators. SC-1 application No. 1 and 2 barrels emptied rapidly lots of oil entered line. Very little oil ended up in sump. No. 1, RS-1 63 gallons on at 9:22 a.m. 9/29/59. Plus 15 for a total of 78 gallons.

Applicator No. 2 RS-1 45 gallons plus 15, total 60 gallons
3 " 15 " " 27 " 42 "
4 " 15 " " 23 " 38 "
5 not on in sump
6 " 7 flow ceased
7 " 7 flow ceased - drum removed
8 " 5 flow ceased
9 " 15 plus 15 gallons 11/9/59 plus 15 gallons 11/10/59 total 45 gallons
10 " 30 " 15 " for 45 gallons total

10/1/59 - Note - on the basis of the previous experience with 15 gallons per applicator not being sufficient 4 evenly spaced applicators were installed between manhole 1-93 and 1-94. On October 1, 1959, 30 gallons of SC-1 was installed in each of the 4 applicators. On October 2, 30 gallons of RS-1. Twenty gallons (approximately) of solidified RS-1 removed from manholes 1-93 and 1-94 while the above 4 drums plus 6 drums upstream from manhole 1-94 were on. Note - the fact that this amount of asphalt was appearing in the manholes 1-93 and 1-94 indicated that the use of the larger slugs of material was bringing the level of asphalt up high enough so that it was actually going past the pipe and therefore entering the line through the leaks and breaks in the line between manhole 1-93 and 1-94.

10/5/59 - Between manhole 1-93 and 1-94 with the 4 applicator 30 gallons RS-1 added to 4 barrels between manhole 1-93 and 1-94. 34 gallons added to No. 1 on 11/6/59. (Note - at this stage of the game it was decided to introduce a new type of soil as another phase of the experimenting with line sealing and with this in mind the following work which was done in L.I.D. 2 was done on a heavy adobe soil. This limited experiment indicated that various parameters in the work to be done in the Federal grant is more work in this type of adobe soil.) L.I.D. No. 2 - 43 main line applicators. No. 9 and No. 10 fifteen plus 5 gallons SC-1 November 2, 1959. Fifteen gallons on October 29, 1959, 5 gallons on November 2, 1959. At 3:30 p.m. 11/2/59 SC-1 had not reached hole therefore, each applicator should have at least twenty gallons total. Added additional 5 gallons SC-1 to following drums: 1 through 29 inclusive.

11/3/59 - There is a sketch of the intersection of Escondido Court and Central Avenue, three applicators 1-two got 33 gallons RS-1. Third one shows 0. No. 93-1 added 33 gallons RS-1. (This pertains to work in L.I.D. 1 again).

11/5/59 - On at 2:25 - 10 gallons empty 2:45 p.m. added another 8 gallons SC-1. On at 3:00 p.m. off at 3:30 p.m. This is applicator No. 12. Added another 6 gallons. On at 3:35 p.m. off at 3:55. No. 12 is minus 10 SC-1. Put this 10 gallons SC-1 in tank and applied to No. 10 applicator at 20 p.s.i. (A sketch below shows an excavated portion of pipe showing applicator No. 10, 43 inches away from the excavated portion of pipe SC-1 at 20 p.s.i. indicated going into the applicator.) No. 8 applicator minus 8 gallons. No. 12 and 13 on 11/9/59 still working on 15 gallons each SC-1 neither taking the SC-1. Verde Vista manhole 1-92 and 1-93 culvert No. 1 applicator at the culvert No. 13 just ahead of manhole No. 1-94 in the sketch. Fifteen gallons SC-1 in each applicator from No. 1 through No. 13. Nos. 9, 10, 11 each took 15 gallons SC-1, 15 gallons RS-1 on line on 11/9/59. No. 8, SC-1 is still on at 11/9/59. No. 7, 15 gallons SC-1, 15 gallons RS-1 on 11/9/59. No. 6, 11/9/59, still on 15 gallons SC-1. No. 5 took 15 gallons SC-1; 15 gallons RS-1 on line on 11/9/59. Nos.

2 and 3 on 15 gallons SC-1, 11/9/59. No. 1, 15 gallons SC-1 and 15 gallons RS-1 on 11/9/59.

11/6/59 - Applicator installed in pit. 25 gallons RS-1 put on line. Didn't go. (Note - it was at this stage that the concept of line sealing changed in that an arbitrary figure of 1.5 gallons per foot of line was no longer the magic number and that in pervious layer such as in this creekbed that an unlimited amount of SC-1 could actually be installed without satisfying the condition. Therefore, they selected the present method of sealing in which the material is fed into the strata for a certain length of time and then if necessary, breaking of the asphalt takes place using salt solution and then the sealing proceeds back up the line from this particular pervious strata.

Nov. 12, 1959 - Between manhole 1-90 and past 1-92 are 19 applicators. Between Nos. 11 and 12 is a creek crossing. Fifteen gallons of SC-1 to 1 through 19 except 60 gallons to No. 12. (Total) RS-1 - No. 1-30, No. 2-10, No. 3-8, No. 4-29, No. 5-8, No. 6-10, No. 7-5, No. 8-0, No. 9-5, No. 10-15, No. 11-30, No. 12-45, No. 13-45, No. 14-65, No. 15-65, No. 16-30, No. 17-35, No. 18-15, No. 19-9.

11/16/59 - Alley L.I.D. 2 - 15 gallons RS-1 on applicators 1 - 13 and first house service on north side.

Nov. 27, 1959 - No. 1 house service 15 gallons RS-1, total 77 RS-1.
No. 2 house service 10 gallons RS-1.

11/17/59 - First left house service 15 gallons RS-1

Second right house service 15 gallons RS-1

Alley applicator No. 33, 40 SC-1, 30 RS-1

34, 25 SC-1, 15 RS-1

11/19/59 - Sketch shows from manhole 1-93 to 1-94 past the pit (the pit then would be upstream from manhole 1-94) No. 1 applicator between manhole 1-93 and 1-94 and 8 applicators between manhole 1-94 and the pit. No. 9 applicator would be upstream from the pit.

11/27/59 - Total for applicator No. 1 would be 50 gallons of RS-1 plus salt plus 10. Applicator No. 2 - 35 minus 10.

3 - plus salt plus 10

4 - 43 plus salt plus 10.

5 - 50 plus salt plus 10

6 - 30 plus salt plus 10

7 - 42½ minus 12

8 - 30

9 - 43 minus 6

(Note: This is the first attempt of using salt to break the asphalt and it was poured in under gravity through a funnel without using the pressure type equipment that is now used. So this is the first attempt at blocking the flow of RS-1 rather than letting the RS-1 go until some further upper limit of total gallons was reached.)

11/21/59 - Salt test No. 4 on at 1:15 p.m. No. 7 on at 2:27 p.m. No. 6 and No. 5 on dye in manhole at 3:20 p.m.

Dec. 14, 1959 - Central Avenue test - put in water in culvert above manhole 1-94 to test line leakage at this point. Water in culvert at 10:50 a.m. 11:50 a.m. no color in manhole 1-94. 1:20 p.m. water clean but trace of green in joints. Refilled culvert. 4:00 p.m. water clean trace of green when line flushed less green than during previous operation at 1:20 p.m. Culvert refilled. Six packs of dye added during day with approximately 600 gallons water. Water left in culvert.

Dec. 28, 1959 - (Sketch of Central Avenue showing 19 applicators between manhole 98 and cleanout 98-1.) Log of applicator holes. (As follows:)

No. 1 - clayish material containing granular particles uniform hole depth. Assume hole as quite porous.

No. 2 - same soil type as No. 1 but ground saturated with water. No free water. Hole should be porous if dampness does not affect same.

No. 3 - same soil type as No. 1 but ground saturated with water. No free water. Hole should be porous if dampness does not affect same.

No. 4 - same as No. 3. Should be porous if dampness does not affect same.

No. 5 - same as No. 1. Somewhat damp but not to the extent of Nos. 2, 3 and 4. Should be porous.

No. 6 - same soil type as No. 1, thoroughly dry. Lower 6 inches caved in with larger particles in this area. Hole should be quite porous.

No. 7 - soil similar to No. 1. Dry hole with some caving in bottom. Hole should be porous.

No. 8 - same soil as No. 1. Hole slightly damp. Some caving at bottom. Fairly dry. Hole probably not as porous as previous ones.

No. 10 - same or similar as No. 9 soil. Finer particles. Some caving at bottom. Fairly dry. Hole probably not as pervious as ones prior to No. 8.

No. 11 - soil similar to that found in No. 9 hole. Some caving in at bottom. Fairly dry. Hole probably not as pervious as ones prior to No. 8 hole.

No. 12 - soil similar to No. 9. Quite dry. Very little caving at bottom. Hole probably not too porous.

No. 13 - soil similar to No. 9. Wetter than No. 12. No caving. Hole probably not too porous.

No. 14 - soil similar to No. 9. Dry hole no caving. Hole probably not too porous.

No. 15 - soil similar to No. 9. Hole very dry and quite crooked. No caving in near bottom. Probably not too porous.

No. 16 - soil similar to No. 9. Hole very dry. No cave in near bottom. Probably not too porous.

No. 17 - soil similar to No. 9. Hole very dry. Hole quite crooked. No cave in near bottom. Probably not too porous.

No. 18 - soil similar to No. 9. Hole very dry. No cave in near bottom. Probably not too porous.

No. 19 - hand dug near cleanout.

The reason for completing the log of the applicator holes and the soil characteristics is to determine the similarity between the types of soil and the manner in which they would absorb the SC-1 and the RS-1.

January 18, 1960 - Two inch water well next to Day's 4 foot 1 inch deep. Two inch water well at Excondido and Central 2.9 feet deep.

January 20, 1960 - No water in well next to Day's. Two and one-half inches water in well at Excondido and Central. Put one package of dye in this well at 9:30 A.M.

January 26, 1960 - Well on Arroyo total depth 4.3 feet. Depth of water equals to .62 feet = 7.44 inches.

January 27, 1960 - Excondido well depth of water four inches. Well at Central Avenue near Las Lomas 1/26/60 depth 1 foot 11 inches. Depth of water at Mockingbird well one foot three inches. On 1/28/60 Central Avenue well 11¼ inches; Mockingbird well 38 inches; Excondido well 2 feet 1½ inches. Davis well - dry. Bay Street 0.43 feet of water. (This concludes Volume No. 4 of EBD Notes......)

MANHOLE

SLIDES

Slide No.	Manhole No.	Date	Time	Weather	Comments
1-0001	2-1	11-8-56	9:00 a.m.	Dry	
1-0002	2-2	11-8-56	9:15 a.m.	Dry	
1-0003	2-3	11-8-56	9:45 a.m.	Dry	
1-0004	2-6	11-8-56	10:00 a.m.	Dry	
1-0005	2-17	11-8-56	10:05 a.m.	Dry	
1-0006	2-25	11-8-56	10:10 a.m.	Dry	
1-0007	2-33	11-8-56	10:15 a.m.	Dry	
1-0008	2-35	11-8-56	10:25 a.m.	Dry	
1-0009	2-36	11-8-56	10:30 a.m.	Dry	
1-0010	2-28	11-8-56	10:35 a.m.	Dry	
1-0011	2-40	11-8-56	10:45 a.m.	Dry	
1-0012	2-5	11-8-56	10:55 a.m.	Dry	
1-0013	2-41	11-8-56	11:00 a.m.	Dry	
1-0014	2-60	11-8-56	11:15 a.m.	Dry	
1-0015	1-6	11-8-56	11:25 a.m.	Dry	
1-0016	T-49	11-8-56	11:30 a.m.	Dry	
1-0017	1-138	11-15-56	11:00 a.m.	Dry	
1-0018	1-113	11-15-56	3:00 p.m.	Dry	
1-0019	1-112	11-15-56	3:01 p.m.	Dry	
1-0020	1-117	11-15-56	3:01 p.m.	Dry	
1-0021	1-104	11-15-56	3:10 p.m.	Dry	
1-0022	1-111	11-15-56	3:06 p.m.	Dry	
1-0023	1-136	11-15-56	3:20 p.m.	Dry	
1-0024	1-105	11-15-56	3:30 p.m.	Dry	

Slide No.	Manhole No.	Date	Time	Weather	Comments
1-0025	1-110	11-15-56	3:35 p.m.	Dry	
1-0026	1-109	11-15-56	3:36 p.m.	Dry	
1-0027	1-108	11-15-56	3:40 p.m.	Dry	
1-0028	1-103	11-15-56	3:42 p.m.	Dry	
1-0029	1-107	11-15-56	3:46 p.m.	Dry	
1-0030	1-106	11-15-56	3:50 p.m.	Dry	
1-0031	1-102	11-15-56	3:55 p.m.	Dry	
1-0032	1-101	11-15-56	4:00 p.m.	Dry	
1-0033	1-140	11-16-56	10:45 a.m.	Dry	
1-0034	1-139	11-16-56	11:00 a.m.	Dry	
1-0035	1-143	11-16-56	11:05 a.m.	Dry	
1-0036	1-142	11-16-56	11:10 a.m.	Dry	
1-0037	1-141	11-16-56	11:15 a.m.	Dry	
1-0038	1-137A	11-16-56	11:25 a.m.	Dry	
1-0039	T-74	11-16-56	11:30 a.m.	Dry	
1-0040	T-75	11-16-56	11:35 a.m.	Dry	
1-0041	T-76B	11-16-56	11:40 a.m.	Dry	
1-0042	T76A	11-16-56	11:42 a.m.	Dry	
1-0043	T-76	11-16-56	11:45 a.m.	Dry	
1-0044	1-116	11-16-56	1:35 p.m.	Dry	
1-0045	1-115	11-16-56	1:40 p.m.	Dry	
1-0046	1-134	11-16-56	1:50 p.m.	Dry	
1-0047	1-133	11-16-56	2:00 p.m.	Dry	
1-0048	1-135	11-16-56	2:05 p.m.	Dry	

Slide No.	Manhole No.	Date	Time	Weather	Comments
1-0049	1-132	11-16-56	2:10 p.m.	Dry	
1-0050	1-131	11-16-56	2:15 p.m.	Dry	
1-0351	2-41	11-27-56	7:52 a.m.		
1-0352	2-60	11-27-56	7:55 a.m.		
1-0353	T-49	11-27-56	7:59 a.m.		
1-0354	1-6	11-27-56	8:03 a.m.		
1-0355	T-57	11-27-56	8:06 a.m.		
1-0356	T-74	12-3-56	6:00 a.m.		
1-0357	T-74	12-3-56	6:15 a.m.		
1-0358	T-74	12-3-56	6:17 a.m.		
1-0359	T-74	12-3-56	6:20 a.m.		
1-0360	T-74	12-3-56	6:25 a.m.		Pr CO_2
1-0375	T-13	12-19-56		Dry	Splude Road construction rein. steel placement
1-0376	T-13	12-19-56		Dry	Splude Road pouring concrete
1-0377	T-13	12-19-56		Dry	Splude Road construction completed
1-0378	2-57	12-20-56	1:05 p.m.	Dry	
1-0379	2-58	12-20-56	1:10 p.m.	Dry	
1-0380	2-59	12-20-56	1:15 p.m.	Dry	
1-0381	2-55	12-20-56	1:45 p.m.	Dry	
1-0382	2-56	12-20-56	1:48 p.m.	Dry	
1-0383	2-57	12-20-56	2:30 p.m.	Dry	
1-0384	1-114	12-20-56	2:41 p.m.	Dry	
1-0386	1-119	12-20-56	2:55 p.m.	Dry	

Slide No.	Manhole No.	Date	Time	Weather	Comments
1-0387	1-120	12-20-56	3:05 p.m.	Dry	
1-0389	1-121	12-20-56	3:20 p.m.	Dry	
1-0390	T-99	12-21-56	2:30 p.m.	Dry	
1-0391	T-98	12-21-56	3:07 p.m.	Dry	
1-0392	T-97	12-21-56	3:20 p.m.	Dry	
1-0393	T-96	12-21-56	3:30 p.m.	Dry	
1-0394	T-91	12-21-56	3:55 p.m.	Dry	
1-0395	T-90	12-21-56	4:00 p.m.	Dry	
1-0396	T-89	12-21-56	4:20 p.m.	Dry	
1-0397	T-85	12-26-56	3:00 p.m.	Dry	
1-0398	T-26	12-26-56	3:15 p.m.	Dry	
1-0399	T-84	12-26-56	3:15 p.m.	Dry	
1-0400	T-83	12-26-56	3:22 p.m.	Dry	
1-0401	T-81	12-26-56	3:40 p.m.	Dry	
1-0402	T-86	12-27-56	11:02 a.m.	Dry	
1-0403	T-77	12-27-56	1:50 p.m.	Dry	
1-0404	T-78	12-27-56	1:55 p.m.	Dry	
1-0405	T-79	12-27-56	2:00 p.m.	Dry	
1-0406	T-80	12-27-56	2:05 p.m.	Dry	
1-0407	T-26A	12-27-56	3:25 p.m.	Dry	
1-0408	T-27	12-27-56	3:28 p.m.	Dry	
1-0409	T-25	12-27-56	3:35 p.m.	Dry	
1-0410	T-24	12-27-56	3:40 p.m.	Dry	
1-0411	T-22	12-27-56	3:50 p.m.	Dry	
1-0412	T-37	12-28-56	3:05 p.m.	Dry	

Slide No.	Manhole No.	Date	Time	Weather	Comments
1-0413	T-36	12-28-56	3:10 p.m.	Dry	
1-0414	T-35	12-28-56	3:52 p.m.	Dry	
1-0415	T-19	1-2-57	2:25 p.m.	Dry	
1-0416	T-20	1-2-57	2:30 p.m.	Dry	
1-0417	T-15	1-2-57	2:45 p.m.	Dry	
1-0418	T-21	1-2-57	2:50 p.m.	Dry	
1-0419	T-28	1-2-57	3:00 p.m.	Dry	
1-0420	T-29	1-2-57	3:05 p.m.	Dry	
1-0421	T-30	1-2-57	3:15 p.m.	Dry	
1-0422	T-31	1-2-57	3:20 p.m.	Dry	
1-0423	T-32	1-2-57	3:25 p.m.	Dry	
1-0424	T-33A	1-2-57	3:33 p.m.	Dry	
1-0425	T-33B	1-2-57	3:35 p.m.	Dry	
1-0426	T-34	1-2-57	3:55 p.m.	Dry	
1-0429	2-36	1-30-57	9:20 a.m.	Wet	
1-0430	2-41	1-13-57	9:30 a.m.	Wet	
1-0431	2-60	1-13-57	9:30 a.m.	Wet	
1-0432	2-63	1-13-57	9:35 a.m.	Wet	
1-0433	T-49	1-13-57	9:55 a.m.	Wet	
1-0434	T-57	1-13-57	10:08 a.m.	Wet	
1-0435	1-14	1-13-57	10:15 a.m.	Wet	
1-0436	1-21	1-13-57	10:20 a.m.	Wet	
1-0437	1-9	1-13-57	10:20 a.m.	Wet	
1-0438	1-65	1-13-57	10:22 a.m.	Wet	
1-0439	1-64	1-13-57	10:25 a.m.	Wet	
1-0440	1-63	1-13-57	10:30 a.m.	Wet	

Slide No.	Manhole No.	Date	Time	Weather	Comments
1-0441	1-61	1-13-57	10:34 a.m.	Wet	
1-0442	1-62	1-13-57	10:35 a.m.	Wet	
1-0443	1-69	1-13-57	10:45 a.m.	Wet	
1-0444	1-70	1-13-57	10:47 a.m.	Wet	
1-0445	1-106	1-13-57	10:50 a.m.	Wet	
1-0446	1-102	1-13-57	10:53 a.m.	Wet	
1-0447	1-103	1-13-57	10:55 a.m.	Wet	
1-0448	1-104	1-13-57	10:58 a.m.	Wet	
1-0449	1-138	1-13-57	11:06 a.m.	Wet	
1-0450	1-137A	1-13-57	11:10 a.m.	Wet	
1-0451	T-74	1-13-57	11:12 a.m.	Wet	
1-0452	1-140	1-13-57	11:18 a.m.	Wet	
1-0453	T-77	1-13-57	11:25 a.m.	Wet	
1-0455	RM-1	1-13-57	11:38 a.m.	Wet	
1-0454	T-88	1-13-57	11:28 a.m.	Wet	
1-0456	T-92	1-13-57	11:45 a.m.	Wet	
1-0457	T-95	1-13-57	11:49 a.m.	Wet	
1-0458	T-99	1-13-57	11:53 a.m.	Wet	
1-0459	1-141	1-13-57	11:02 a.m.	Wet	
1-0460	T-26	1-20-57	3:10 a.m.	Wet	
1-0461	T-38	1-20-57	3:20 a.m.	Wet	
1-0462	2-40	1-20-57	3:28 a.m.	Wet	
1-0463	2-31	1-20-57	4:40 a.m.	Wet	
1-0464	2-3	1-20-57	3:42 a.m.	Wet	
1-0465	BA-1	1-20-57	3:48 a.m.	Wet	

Slide No.	Manhole No.	Date	Time	Weather	Comments
1-0466	2-18	1-20-57	3:52 a.m.	Wet	
1-0467	2-74	1-20-57	1:55 a.m.	Wet	
1-0468	2-19	1-20-57	3:58 a.m.	Wet	
1-0470	2-27	1-20-57	4:06 a.m.	Wet	
1-0471	2-28	1-20-57	4:10 a.m.	Wet	
1-0469	2-26	1-20-57	4:04 a.m.	Wet	
1-0472	2-20	1-20-57	4:17 a.m.	Wet	
1-0473	2-21	1-20-57	4:30 a.m.	Wet	
1-0474	2-29	1-20-57	4:30 a.m.	Wet	
1-0475	2-30	1-20-57	4:33 a.m.	Wet	
1-0476	2-17	1-20-57	3:36 a.m.	Wet	
1-0477	2-19	1-20-57	4:42 a.m.	Wet	
1-0478	2-6	1-20-57	4:48 a.m.	Wet	
1-0479	T-63	1-20-57	4:50 a.m.	Wet	
1-0480	T-64	1-20-57	4:52 a.m.	Wet	
1-0481	1-47	1-20-57	5:00 a.m.	Wet	
1-0482	1-48	1-20-57	5:02 a.m.	Wet	
1-0483	1-49	1-20-57	5:06 a.m.	Wet	
1-0484	1-64	1-20-57	5:14 a.m.	Wet	
1-0485	1-85	1-20-57	5:18 a.m.	Wet	
1-0486	1-87	1-20-57	5:21 a.m.	Wet	
1-0487	1-89	1-20-57	5:30 a.m.	Wet	
1-0488	1-90	1-30-57	5:33 a.m.	Wet	
1-0489	1-88	1-20-57	5:35 a.m.	Wet	
1-0490	1-92	1-20-57	5:42 a.m.	Wet	

Slide No.	Manhole No.	Date	Time	Weather	Comments
1-0491	1-99	1-20-57	5:46 a.m.	Wet	
1-0492	1-91	1-20-57	5:47 a.m.	Wet	
1-0493	1-93	1-20-57	5:51 a.m.	Wet	
1-0494	1-94	1-20-57	5:54 a.m.	Wet	
1-0495	1-95	1-20-57	6:04 a.m.	Wet	
1-0496	1-97	1-20-57	6:10 a.m.	Wet	
1-0497	1-96	1-20-57	6:11 a.m.	Wet	
1-0498	1-98	1-20-57	6:15 a.m.	Wet	
1-0499	1-90	1-20-57	6:18 a.m.	Wet	
1-0500	1-64	1-20-57	6:23 a.m.	Wet	
1-0501	1-65	1-20-57	6:27 a.m.	Wet	
1-0502	1-67	1-20-57	6:31 a.m.	Wet	
1-0503	1-6	1-20-57	6:37 a.m.	Wet	
1-0504	1-7	1-20-57	6:42 a.m.	Wet	
1-0505	1-7A	1-20-57	6:45 a.m.	Wet	
1-0506	1-6A	1-20-57	6:50 a.m.	Wet	
1-0507	2-36	1-20-57	6:56 a.m.	Wet	
1-0508	2-40	1-20-57	7:22 a.m.	Wet	
1-0509	1-137A	2-7-57	2:20 p.m.	Wet	
1-0510	T-74	2-7-57	2:25 p.m.	Wet	
1-0511	1-137B	2-7-57	2:30 p.m.	Wet	
1-0512	1-138	2-7-57	2:35 p.m.	Wet	
1-0513	1-139	2-7-57	2:43 p.m.	Wet	
1-0514	1-139	2-7-57		Wet	Infiltration through pick hole

Slide No.	Manhole No.	Date	Time	Weather	Comments
1-0515	1-140	2-7-57	2:53 p.m.	Wet	
1-0516	1-140	2-7-57	3:00 p.m.	Wet	Water entering lid
1-0517	1-140	2-7-57	3:00 p.m.	Wet	Water over lid
1-0518	1-141	2-7-57	3:03 p.m.	Wet	Manhole cover inundated
1-0519	1-141	2-7-57	3:00 p.m.	Wet	
1-0520	1-142	2-7-57	3:08 p.m.	Wet	
1-0521	1-143	2-7-57	3:17 P.m.	Wet	
1-0522	1-104	2-7-57	3:31 p.m.	Wet	
1-0523	1-104	2-7-57	3:38 p.m.	Wet	
1-0524	1-101	2-7-57	3:43 p.m.	Wet	
1-0525	T-69A	2-7-57	3:53 p.m.	Wet	
1-0526	1-139	2-13-57	9:35 a.m.	Dry	Prior to water test
1-0527	1-139	2-13-57			Leakage past test plug
1-0528	1-140	2-13-57	9:42 a.m.	Dry	Prior to water test
1-0529	1-141	2-13-57	1:20 p.m.	Dry	Prior to water test
1-0530	1-138	2-13-57	1:15 p.m.	Dry	Prior to water test
1-0531	1-104	2-13-57	3:00 p.m.	Dry	Prior to water test
1-0532	1-103	2-13-57	3:27 p.m.	Dry	Prior to water test
1-0533	2-63	2-23-57	3:47 p.m.	Wet	
1-0534	T-74	2-23-57	4:00 p.m.	Wet	
1-0535	T-74	2-24-57	9:47 a.m.	Wet	
1-0536	2-63	2-24-57	10:03 a.m.	Wet	
1-0537	T-37	2-24-57	10:16 a.m.	Wet	
1-0538	T-29	2-24-57	10:42 a.m.	Wet	
1-0539	1-137A	2-24-57	10:53 a.m.	Wet	

Slide No.	Manhole No.	Date	Time	Weather	Comments
1-0540	2-47	2-24-57	2:28 p.m.	Wet	
1-0541	2-48	2-24-57	2:34 p.m.	Wet	
1-0542	2-49	2-24-57	2:38 p.m.	Wet	
1-0543	2-38	2-24-57	2:48 p.m.	Wet	
1-0544	2-41	2-24-57	2:51 p.m.	Wet	
1-0545	2-55	2-24-57	2:54 p.m.	Wet	
1-0546	2-56	2-24-57	2:58 p.m.	Wet	
1-0547	2-57	2-24-57	3:01 p.m.	Wet	
1-0548	2-58	2-24-57	3:03 p.m.	Wet	
1-0549	2-59	2-24-57	3:07 p.m.	Wet	
1-0551	2-47	2-25-57	9:30 a.m.	Wet	
1-0552	2-48	2-25-57	9:40 a.m.	Wet	
1-0553	2-49	2-25-57	9:45 a.m.	Wet	
1-0554	2-35	2-25-57	9:55 a.m.	Wet	
1-0555	2-33	2-25-57	10:00 a.m.	Wet	
1-0556	2-32	2-25-57	10:10 a.m.	Wet	
1-0557	2-25A	2-25-57	10:15 a.m.	Wet	
1-0558	2-25	2-25-57	10:15 a.m.	Wet	
1-0559	2-23	2-25-57	10:20 a.m.	Wet	
1-0560	2-6	2-25-57	10:30 a.m.	Wet	
1-0561	2-5	2-25-57	10:35 a.m.	Wet	
1-0562	2-3	2-25-57	10:45 a.m.	Wet	
1-0563	T-92	2-25-57	11:25 a.m.	Wet	
1-0564	T-93	2-25-57	11:30 a.m.	Wet	
1-0565	T-94	2-25-57	11:40 a.m.	Wet	

Slide No.	Manhole No.	Date	Time	Weather	Comments
1-0566	T-95	2-25-57	11:45 a.m.	Wet	
1-0567	1-5	2-25-57	2:20 p.m.	Wet	
1-0568	1-2	2-25-57	2:30 p.m.	Wet	
1-0569	1-3	2-25-57	2:30 p.m.	Wet	
1-0570	1-1	2-25-57	2:35 p.m.	Wet	
1-0571	T-49	2-25-57	2:40 p.m.	Wet	
1-0572	1-14	2-25-57	2:50 p.m.	Wet	
1-0573	1-15	2-25-57	2:55 p.m.	Wet	
1-0574	T-57	2-25-57	3:00 p.m.	Wet	
1-0575	T-60	2-25-57	3:10 p.m.	Wet	
1-0576	T-61	2-25-57	3:15 p.m.	Wet	
1-0577	T-63	2-25-57	3:20 p.m.	Wet	
1-0578	1-52	2-26-57	10:10 a.m.	Wet	
1-0579	1-53	2-26-57	10:15 a.m.	Wet	
1-0580	T-66	2-26-57	10:20 a.m.	Wet	
1-0581	T-67	2-26-57	10:30 a.m.	Wet	
1-0582	T-68	2-26-57	10:35 a.m.	Wet	
1-0583	T-69	2-26-57	10:40 a.m.	Wet	
1-0584	T-69A	2-26-57	10:45 a.m.	Wet	
1-0585	T-71	2-26-57	10:50 a.m.	Wet	
1-0586	T-72	2-26-57	11:25 a.m.	Wet	
1-0587	T-73	2-26-57	11:35 a.m.	Wet	
1-0588	1-137A	2-26-57	11:47 a.m.	Wet	
1-0589	1-104	2-26-57	11:10 a.m.	Wet	
1-0590	1-102	2-26-57	11:15 a.m.	Wet	

Slide No.	Manhole No.	Date	Time	Weather	Comments
1-0591	1-49	2-26-57	2:10 p.m.	Wet	
1-0592	1-49A	2-26-57	2:20 p.m.	Wet	
1-0593	1-69	2-26-57	3:35 p.m.	Wet	
1-0594	1-62	2-26-57	3:50 p.m.	Wet	
1-0595	1-137A	2-27-57	9:40 a.m.	Wet	
1-0596	1-137A	2-27-57	3:55 p.m.	Wet	
1-0597	3-2	2-27-57	4:05 p.m.	Wet	
1-0598	3-3	2-27-57	4:10 p.m.	Wet	
1-0599	1-61	2-28-57	11:25 a.m.	Wet	
1-0600	T-38	2-28-57	12:45 p.m.	Wet	
1-0601	T-45	3-28-57	10:00 a.m.	Dry	
1-0602	T-46	3-28-57	10:00 a.m.	Dry	
1-0603	T-42	3-28-57	10:00 a.m.	Dry	
1-0604		3-28-57	10:15 a.m.	Dry	
1-0605	T-95	4-9-57	2:04 p.m.	Dry	
1-0606	T-94	4-23-57	4:15 p.m.	Dry	
1-0607	T-92	5-21-57	3:00 p.m.	Dry	
1-0608	T-93	5-21-57	3:15 p.m.	Dry	
1-0609	T-88	5-22-57	2:05 p.m.	Dry	
1-0610	T-88A	5-22-57	2:15 p.m.	Dry	
1-0611	T-86A	5-22-57	2:30 p.m.	Dry	
1-0612	T-88	6-6-57	4:00 p.m.	Dry	
1-0613	T-88A	6-6-57	4:15 p.m.	Dry	
1-0614	T-86A	6-6-57	4:30 p.m.	Dry	
1-0615	1-100	7-9-57	9:15 a.m.	Dry	

Slide No.	Manhole No.	Date	Time	Weather	Comments
1-0616	T-95	7-17-57	2:30 p.m.	Dry	
1-0617	T-92	7-17-57	3:37 p.m.	Dry	
1-0623	2-41	9-19-57	11:58 a.m.	Dry	Plugged for water test
1-0624	T-95	10-23-57	9:50 a.m.	Wet	
1-0625	T-92	10-23-57	9:53 a.m.	Wet	
1-0626	T-74	10-23-57	10:03 a.m.	Wet	
1-0627	1-137A	10-23-57	10:11 a.m.	Wet	
1-0628	1-104	10-23-57	10:17 a.m.	Wet	
1-0629	T-67	10-23-57	10:25 a.m.	Wet	
1-0630	1-64	10-23-57	10:33 a.m.	Wet	
1-0631	1-14	10-23-57	10:40 a.m.	Wet	
1-0632	T-38	10-23-57	10:46 a.m.	Wet	
1-0633	2-60	10-23-57	10:54 a.m.	Wet	
1-0634	2-41	10-23-57	10:59 a.m.	Wet	
1-0635	2-43	10-23-57	11:04 a.m.	Wet	
1-0636	2-6	10-23-57	11:24 a.m.	Wet	
1-0637	T-30	10-23-57	11:42 a.m.	Wet	
1-0638	T-95	10-23-57	2:17 p.m.	Wet	
1-0639	T-92	10-23-57	2:20 p.m.	Wet	
1-0640	T-74	10-23-57	2:30 p.m.	Wet	
1-0641	1-137A	10-23-57	2:39 p.m.	Wet	
1-0642	1-104	10-23-57	2:43 p.m.	Wet	
1-0643	T-67	10-23-57	2:47 p.m.	Wet	
1-0644	1-64	10-23-57	2:52 p.m.	Wet	
1-0645	1-14	10-23-57	2:56 p.m.	Wet	

Slide No.	Manhole No.	Date	Time	Weather	Comments
1-0646	T-38	10-23-57	3:02 p.m.	Wet	
1-0647	2-60	10-23-57	3:07 p.m.	Wet	
1-0648	2-41	10-23-57	3:12 p.m.	Wet	
1-0649	2-43	10-23-57	3:16 p.m.	Wet	
1-0650	2-19	10-23-57	3:26 p.m.	Wet	
1-0651	2-06	10-23-57	3:31 p.m.	Wet	
1-0652	T-30	10-23-57	3:44 p.m.	Wet	Dye test
1-0653	1-95	10-30-57		Dry	
1-0654	1-17	10-23-57		Dry	Dye test
1-0655	3-3	11-20-57	10:00 a.m.	Dry	
1-0656	1-137B	11-16-57	11:20 a.m.	Dry	
1-0659	T-72	1-20-58		Dry	Repair of leaking drop manhole.
1-0663		1-24-58	11:02 a.m.		Sonoma meter station
1-0664		1-24-58	11:05 a.m.		First manhole north of Sonoma meter station
1-0665	T-99	1-24-58	9:15 a.m.		
1-0666	T-88	1-24-58	9:32 a.m.		
1-0667	T-86	1-24-58	9:40 a.m.		
1-0668	T-76	1-24-58	9:52 a.m.		
1-0669	T-49	1-24-58	10:05 a.m.		
1-0670	T-38	1-24-58	10:17 a.m.	Wet	
1-0671	36	1-24-58	10:30 a.m.		
1-0672	T-27	1-24-58	10:50 a.m.		
1-0673	T-26	1-24-58	11:08 a.m.		
1-0674	T-74	1-24-58	12:25 p.m.		

Slide No.	Manhole No.	Date	Time	Weather	Comments
1-0675	2-33	1-24-58	1:30 p.m.		
1-0676	2-22	1-24-58	1:37 p.m.	Wet	
1-0677	2-1	1-24-58	1:43 p.m.	Wet	
1-0678	T-44	1-27-58		Dry	
1-0679	T-95	1-30-58	9:35 a.m.	Dry	
1-0680	T-95	1-30-58	9:35 a.m.	Dry	
1-0681	2-6	1-30-58	10:17 a.m.	Dry	
1-0682	2-17	1-30-58	10:22 a.m.	Dry	
1-0683	2-44	1-30-58	10:27 a.m.	Dry	
1-0684	2-55	1-30-58	10:33 a.m.	Dry	
1-0685	2-41	1-30-58	10:37 a.m.	Dry	
1-0686	2-68	1-30-58	10:43 a.m.	Dry	
1-0687	1-2	1-30-58	10:54 a.m.	Dry	
1-0688	1-137A	1-30-58	11:12 a.m.	Dry	
1-0689	T-74	1-30-58	11:20 a.m.	Dry	
1-0690	1-102	1-30-58	11:26 a.m.	Dry	
1-0681	1-61	1-30-58	11:43 a.m.	Dry	
1-0692	T-63	1-30-58	11:49 a.m.	Dry	
1-0693	1-14	1-30-58	1:03 p.m.	Dry	
1-0694	T-95	1-30-58	1:15 p.m.	Dry	
1-0695	2-6	1-30-58	1:26 p.m.	Dry	
1-0696	2-7	1-30-58	1:30 p.m.	Dry	
1-0697	2-44	1-30-58	1:34 p.m.	Dry	
1-0698	2-55	1-30-58	1:37 p.m.	Dry	
1-0699	2-41	1-30-58	1:40 p.m.	Dry	

Slide No.	Manhole No.	Date	Time	Weather	Comments
1-0700	2-68	1-30-58	1:45 p.m.	Dry	
1-0703	1-61	1-30-58	3:03 p.m.	Dry	
1-0704	1-102	1-30-58	3:07 p.m.	Dry	
1-0705	1-137A	1-30-58	3:10 p.m.	Dry	
1-0707	T-74	1-30-58	3:14 p.m.	Dry	
1-0707	T-63	1-30-58	3:27 p.m.	Dry	
1-0708	1-2	1-30-58	3:50 p.m.	Dry	
1-0709	1-14	1-30-58	3:55 p.m.	Dry	
1-0710	T-95	1-30-58	4:07 p.m.	Dry	
1-0713	2-19	1-30-58	2:00 p.m.	Dry	
1-0715	T-95	2-4-58	12:00 noon	Dry	
1-0716	T-38	2-4-58	3:33 p.m.	Dry	
1-0717	T-38	2-4-58	12:34 p.m.	Dry	
1-0718	T-38	2-4-58	12:34 p.m.	Dry	
1-0719	2-BA-1	2-4-58	1:04 p.m.	Dry	
1-0720		2-4-58	1:30 p.m.	Dry	Sonoma City meter
1-0721	2-19	2-4-58	1:49 p.m.	Dry	
1-0722	2-17	2-4-58	1:57 p.m.	Dry	
1-0723	T-95	2-4-58	3:45 p.m.	Dry	
1-0725	T-74	2-5-58	9:40 a.m.	Wet	
1-0726	1-137A	2-5-58	9:42 a.m.	Wet	
1-0727	1-139	2-5-58	9:50 a.m.	Wet	
1-0728	1-139	2-5-58	9:50 a.m.	Wet	
1-0729	1-140	2-5-58	9:04 a.m.	Wet	
1-0730	1-104	2-5-58	10:09 a.m.	Wet	

Slide No.	Manhole No.	Date	Time	Weather	Comments
1-0731	1-111	2-5-58	10:11 a.m.	Wet	
1-0732	1-112	2-5-58	10:15 a.m.	Wet	
1-0733	1-113	2-5-58	10:18 a.m.	Wet	
1-0734	1-114	2-5-58	10:22 a.m.	Wet	
1-0735	1-115	2-5-58	10:27 a.m.	Wet	
1-0736	1-116	2-5-58	10:30 a.m.	Wet	
1-0737	1-131	2-5-58	10:35 a.m.	Wet	
1-0738		2-5-58	10:55 a.m.	Wet	City of Sonoma meter
1-0740	1-117	2-5-58	11:22 a.m.	Wet	
1-0741	1-119	2-5-58	11:31 a.m.	Wet	
1-0742	T-70	2-5-58	1:18 p.m.	Dry	
1-0743	T-71	2-5-58	1:25 p.m.	Dry	
1-0744	1-100	2-5-58	1:30 p.m.	Dry	
1-0745	1-101	2-5-58	1:35 p.m.	Dry	
1-0746	1-103	2-5-58	1:40 p.m.	Dry	
1-0747	1-108	2-5-58	1:45 p.m.	Dry	
1-0748	1-109	2-5-58	1:49 p.m.	Dry	
1-0749	1-110	2-5-58	1:54 p.m.	Dry	
1-0750	1-75	2-5-58	2:00 p.m.	Dry	
1-0751	1-74	2-5-58	2:03 p.m.	Dry	
1-0752	1-73	2-5-58	2:10 p.m.	Dry	
1-0753	1-69	2-5-58	2:11 p.m.	Dry	
1-0754	2-40	2-5-58	2:50 p.m.	Wet	
1-0755	2-38	2-5-58	2:55 p.m.	Dry	
1-0756	2-56	2-5-58	3:00 p.m.	Dry	

Slide No.	Manhole No.	Date	Time	Weather	Comments
1-0757	2-57	2-5-58	3:01 p.m.	Dry	
1-0758	2-46	2-5-58	3:09 p.m.	Dry	
1-0759	2-47	2-5-58	3:13 p.m.	Dry	
1-0760	2-52	2-5-58	3:16 p.m.	Dry	
1-0761	2-49	2-5-58	3:21 p.m.	Dry	
1-0762	T-49	2-17-58	9:35 a.m.	Wet	
1-0763	T-95	2-7-58	9:50 a.m.	Wet	
1-0764	1-144	2-7-58	10:10 a.m.	Wet	
1-0765	T-45	2-7-58	10:30 a.m.	Wet	
1-0766	T-38	2-7-58	10:40 a.m.	Wet	
1-0769	T-74	2-7-58	11:06 a.m.	Wet	
1-0770	T-49	2-7-58	11:43 a.m.	Wet	
1-0771	T-95	2- 8-58	11:19 a.m.	Dry	
1-0772	T-95	2-10-58	9:10 a.m.		Water depth .42 feet
1-0773	T-44	2-11-58	1:55 p.m.		
1-0774	T-44	2-13-58	2:00 p.m.		
1-0775	T-95	2-14-58	2:10 p.m.		Water depth 0.05 feet
1-0780	T-95	2-18-58	1:35 p.m.		Water depth 0.47 feet
1-0783	T-95	2-19-58	1:37 p.m.		Water depth 0.5 feet
1-0784	T-38	2-19-58	2:09 p.m.	Wet	
1-0790	T-44	2-19-58	2:53 p.m.	Wet	
1-0791	T-44	2-19-58	2:53 p.m.	Wet	
1-0792	T-95	2-20-58	9:17 a.m.	Wet	Water depth 0.51 feet
1-0793	T-95	2-21-58	9:35 a.m.	Wet	Water depth 0.57 feet
1-0798	T-95	2-24-58	11:17 a.m.	Wet	Water depth 0.76 feet

Slide No.	Manhole No.	Date	Time	Weather	Comments
1-0799	T-95	2-25-58	9:40 a.m.	Wet	Water depth 0.45 ft.
1-0800	1-4	2-25-58	3:26 p.m.	Wet	
1-0801	1-4	2-25-58	3:31 p.m.	Wet	
1-0802	1-64	2-25-58	3:36 p.m.	Wet	
1-0803	1-61	2-25-58	3:43 p.m.	Wet	
1-0804	1-104	2-28-58	3:48 p.m.	Wet	
1-0805	1-139	2-25-58	3:55 p.m.	Wet	
1-0806	T-95	2-26-58	9:02 a.m.	Dry	
1-0807	2-47	2-26-58	9:45 a.m.	Dry	
1-0808	2-38	2-26-58	10:02 a.m.	Dry	
1-0809	2-40	2-26-58	10:10 a.m.	Dry	
1-0810	2-61	2-26-58	10:20 a.m.	Dry	
1-0811	2-66	2-26-58	10:31 a.m.	Dry	
1-0812	2-64	2-26-58	10:44 a.m.	Dry	
1-0813	2-17	2-26-58	11:11 a.m.	Dry	
1-0814	2-19	2-26-58	11:18 a.m.	Dry	
1-0815	2-20	2-26-58	11:23 a.m.	Dry	
1-0816	2-7	2-26-58	11:30 a.m.	Dry	
1-0817	1-6	2-26-58	2:00 p.m.	Dry	
1-0818	1-146	2-26-58	2:16 p.m.	Dry	
1-0819	1-150	2-26-58	2:27 p.m.	Dry	
1-0820	1-16	2-26-58	3:03 p.m.	Dry	
1-0821	1-27	2-26-58	3:13 p.m.	Dry	
1-0822	T-95	2-28-58	8:57 a.m.	Dry	Water depth .45
1-0824	2-61	2-28-58	11:22 a.m.	Dry	
1-0825	2-41	2-28-58	11:28 a.m.	Dry	

Slide No.	Manhole No.	Date	Time	Weather	Comments
1-0826	2-38	2-28-58	11:32 a.m.	Dry	
1-0827	2-20	2-28-58	11:40 a.m.	Dry	
1-0828	1-146	2-28-58	1:04 p.m.	Dry	
1-0829	2-64	2-28-58	1:12 p.m.	Dry	
1-0830	1-16	2-28-58	1:20 p.m.	Dry	
1-0831	1-27	2-28-58	1:26 p.m.	Dry	
1-0859	T-95	3-3-58	2:10 p.m.	Dry	Water depth 0.38 feet
1-0860	2-64	3-3-58	3:45 p.m.	Dry	
1-0861	2-61	3-3-58	3:50 p.m.	Dry	
1-0862	2-38	3-3-58	3:58 p.m.	Dry	
1-0863	T-74	3-5-58	3:05 p.m.	Dry	
1-0864	T-74	3-10-58	9:25 a.m.	Dry	
1-0865	1-17	3-10-58	11:05 a.m.	Dry	Dye from water level pipe.
1-0866	2-47	3-17-58		Dry	22 Minutes After Dye Test Start
1-0867	2-47	3-17-58		Dry	13 Minutes After Dye Test Start
1-0868	2-57	3-18-58		Dry	13 Minutes After Dye Test Start
1-0869	2-57	3-18-58		Dry	16 Minutes After Dye Test Start
1-0870	2-57	3-18-58		Dry	19 Minutes After Dye Test Start
1-0871	2-57	3-18-58		Dry	33 Minutes After Dye Test Start
1-0872	1-17	3-18-58		Dry	15 Minutes After Dye Test Start

Slide No.	Manhole No.	Date	Time	Weather	Comments
1-0873	1-17	3-18-58		Dry	19 Minutes After Dye Test Start
1-0874	1-88	3-18-58			20 Minutes After Dye Test Start
1-0875	1-92	3-18-58		Wet	4 Minutes After Dye Test Start
1-0876	1-92	3-18-58		Wet	6 Minutes After Dye Test Start
1-0877	2-20	3-18-58		Wet	20 Minutes After Dye Test Start
1-0878	3-3	3-18-58		Wet	
1-0879	T-95	3-21-58	11:45 a.m.		.65 Water Depth
1-0880	2-47	3-25-58			6 Minutes After Dye Test Start
1-0881	2-57	3-25-58			7 Minutes After Dye Test Start
1-0882	1-88	3-25-58	11:10 a.m.		8 Minutes After Dye Test Start
1-0883	1-17	3-25-58			10 Minutes After Dye Test Start
1-0884	3-3	3-25-58			19 Minutes After Dye Test Start
1-0886	1-137A	4-28-58		Dry	
1-0887	T-39	10-3-58		Dry	
1-0888	2-67	10-3-58		Dry	
1-0889	T-40	10-3-58	9:35 a.m.	Dry	
1-0890	T-48	10-3-58	9:45 a.m.	Dry	
1-0891	T-50	10-3-58	9:55 a.m.	Dry	
1-0892	T-51	10-3-58	10:00 a.m.	Dry	
1-0893	T-52A	10-3-58	10:20 a.m.	Dry	

Slide No.	Manhole No.	Date	Time	Weather	Comments
1-0894	T-55	10-3-58	10:35 a.m.	Dry	
1-0895	T-58	10-3-58	1:20 p.m.	Dry	
1-0896	T-59	10-3-58	1:25 p.m.	Dry	
1-0897	1-3	10-3-58	2:10 p.m.	Dry	
1-0898	1-155	10-3-58	2:17 p.m.	Dry	
1-0899	2-33A	10-3-58	2:30 p.m.	Dry	
1-0900	1-56	10-3-58	2:40 p.m.	Dry	
1-0901	1-60	10-3-58	3:00 p.m.	Dry	
1-0902	2-30	10-3-58	3:25 p.m.	Dry	
1-0903	3-1	10-7-58	9:25 a.m.	Dry	
1-0904	3-2	10-7-58	9:30 a.m.	Dry	
1-0905	3-3	10-7-58	9:35 a.m.	Dry	
1-0906	T-68	10-7-58	9:55 a.m.	Dry	
1-0907	1-123	10-7-58	10:05 a.m.	Dry	
1-0908	1-35	10-7-58	10:40 a.m.	Dry	
1-0909	1-34	10-7-58	10:50 a.m.	Dry	
1-0910	1-147	10-7-58	11:25 a.m.	Dry	
1-0911	1-150	10-7-58	11:35 a.m.	Dry	
1-0912	1-151	10-7-58	11:40 a.m.	Dry	
1-0913	1-153	10-7-58	11:45 a.m.	Dry	
1-0914	1-154	10-7-58	11:50 a.m.	Dry	
1-0915	T-34A	10-7-58	1:50 p.m.	Dry	
1-0916	T-34B	10-7-58	1:55 p.m.	Dry	
1-0917	T-27A	10-7-58	2:00 p.m.	Dry	
1-0918	T-26	10-7-58	2:10 p.m.	Dry	

Slide No.	Manhole No.	Date	Time	Weather	Comments
1-0919	T-23	10-7-58	2:40 p.m.	Dry	
1-0920	T-18	10-7-58	2:45 p.m.	Dry	
1-0921	1-4	1-2-59		Dry	New channel
1-0922	1-91	1-9-59	11:10 a.m.	Wet	
1-0923	1-92	1-9-59	11:15 a.m.	Wet	
1-0924	1-99	1-9-59	11:20 a.m.	Wet	
1978	1-81	3-10-60	9:45 a.m.	Wet	
1979	1-82	3-10-60	9:45 a.m.	Wet	
1980	1-83	3-10-60	11:00 a.m.	Wet	
1981	1-84	3-10-60	11:00 a.m.	Wet	
1-0925	T-26	1-9-59	1:20 p.m.	Wet	
1-0926	1-15	1-9-59	2:30 p.m.	Wet	
1-0927	1-19	1-9-59	2:35 p.m.	Wet	
1-0928	1-94	1-9-59	2:40 p.m.	Wet	
1-0929	1-93	1-9-59	2:45 p.m.	Wet	5.6 inches total rain
1-0930	1-99	1-9-59	3:00 p.m.	Wet	
1-0931	1-92	1-9-59	3:05 p.m.	Wet	
1-0958	T-78	2-16-59			
1-0959	T-74	2-16-59	9:20 a.m.	Wet	
1-0960	T-76	2-16-59	9:26 a.m.	Wet	
1-0961	T-76B	2-16-59	9:30 a.m.	Wet	
1-0962	T-69A	2-16-59	9:36 a.m.	Wet	
1-0963	1-100	2-16-59	9:43 a.m.	Wet	
1-0964	T-63	2-16-59	9:48 a.m.	Wet	
1-0965	T-66	2-16-59	9:54 a.m.	Wet	

Slide No.	Manhole No.	Date	Time	Weather	Comments
1-0966	T-57	2-16-59	10:02 a.m.	Wet	
1-0967	T-49	2-16-59	10:17 a.m.	Wet	
1-0968	T-44	2-16-59	11:34 a.m.	Wet	
1-0969	T-46	2-16-59	10:41 a.m.	Wet	
1-0973	1-99	2-16-59	11:36 a.m.	Wet	
1-0974	1-92	2-16-59	11:44 a.m.	Wet	11.5 inches total rain
1-0975	1-94	2-16-59	11:49 a.m.	Wet	
1-0976	1-15	2-16-59	1:15 p.m.	Wet	
1-0977	1-19	2-16-59	1:20 p.m.	Wet	
1-0978	T-77	2-16-59	3:15 p.m.	Wet	
1-0980	1-94	7-30-59		Dry	
1-0981	1-90	8-12-59		Dry	
1-0982	1-91	8-12-59		Dry	
1-0983	1-92	8-12-59		Dry	
1-0984	1-95	8-12-59		Dry	
1-0985	1-64	8-14-59		Dry	
1-0986	1-85	8-14-59		Dry	
1-0987	1-86	8-14-59		Dry	
1-0988	1-88	8-14-59		Dry	
1-0983	1-88	8-14-59		Dry	
1-0990	1-89	8-14-59		Dry	
1-0991	1-96	8-14-59		Dry	
1-0992	1-97	8-14-59		Dry	
1-0993	1-98	8-14-59		Dry	
1-0637	94	12-14-59	3:40 p.m.	Dry	

Slide No.	Manhole No.	Date	Time	Weather	Comments
1-0638	94	12-14-59	3:40 p.m.	Dry	
1-0639	94	12-14-59	3:40 p.m.	Dry	
1-0640	94	12-14-59	3:40 p.m.	Dry	
1-1641	94	12-15-59	9:40 a.m.	Dry	
1-1642	94	12-15-59	9:40 a.m.	Dry	
1-1643	94	12-15-59	9:45 a.m.	Dry	Upstream culvert
1-1644	1-89	12-23-59	3:50 p.m.		0.8 inches of rain
1-1645	1-90	12-23-59	3:50 p.m.		0.8 inches of rain
1-1646	1-90	12-23-59	3:50 p.m.		0.8 inches of rain
1-1647	1-91	12-23-59	3:45 p.m.		0.8 inches of rain
1-1648	1-91	12-23-59	3:45 p.m.		0.8 inches of rain
1-1649	1-92	12-23-59	3:45 p.m.		0.8 inches of rain
1-1650	1-93	12-23-59	3:40 p.m.		0.8 inches of rain
1-1651	1-94	12-23-59	3:30 p.m.		0.8 inches of rain
1-1652	1-94	12-23-59	3:30 p.m.		0.8 inches of rain
1-1653	1-99	12-23-59	9:30 a.m.		0.8 inches of rain
1-1654	1-99	12-23-59	3:50 p.m.		0.8 inches of rain
1-1655	1-90	12-24-59	10:15 a.m.		1.2 inches of rain
1-1656	1-91	12-24-59	10:15 a.m.		1.2 inches of rain
1-1657	1-92	12-24-59	9:45 a.m.		1.2 inches of rain total
1-1658		12-24-59	10:10 a.m.		1.2 inches of rain total
1-1659	1-93	12-24-59	10:00 a.m.		1.2 inches of rain Total
1-1660	1-99	12-24-59	10:10 a.m.		1.2 inches of rain total

Slide No.	Manhole No.	Date	Time	Weather	Comments
1-1661	1-90	1-8-60	11:35 a.m.		1.8 inches of rain total
1-1662	1-91	1-8-60	11:30 a.m.		1.8 inches of rain total
1-1663	1-92	1-8-60	11:25 a.m.		1.8 inches of rain total
1-1664	1-93	1-8-60	11:20 a.m.		1.8 inches of rain total
1-1665	1-94	1-8-60	11:15 a.m.		1.8 inches of rain total
1-1666	1-99	1-8-60	11:25 a.m.		1.8 inches of rain total
1-1667	1-90	1-8-60	10:30 a.m.		2.9 inches of rain total
1-1668	1-90	1-11-60	2:00 p.m.		3.3 inches of rain total
1-1669	1-91	1-11-60	10:00 a.m.		2.9 inches of rain total
1-1670	1-91	1-11-60	2:00 p.m.		3.3 inches of rain total
1-1671	1-92	1-11-60	10:00 a.m.		2.9 inches of rain total
1-1672	1-92	1-11-60	2:00 p.m.		3.3 inches of rain total
1-1673	1-93	1-11-60	10:00 a.m.		2.9 inches of rain total
1-1674	1-93	1-11-60	2:00 p.m.		3.3 inches of rain total
1-1675	1-94	1-11-60	10:00 a.m.		2.9 inches of rain total
1-1676	1-94	1-11-60	2:00 p.m.		3.3 inches of rain total
1-1677	1-95	1-11-60	2:40 p.m.	Wet	

Slide No.	Manhole No.	Date	Time	Weather	Comments
1-1678	1-96	1-11-60	2:45 p.m.	Wet	
1-1679	1-97	1-11-60	2:45 p.m.	Wet	
1-1680	1-98	1-11-60	2:50 p.m.	Wet	
1-1681	1-99	1-11-60	10:00 a.m.	Wet	2.10 inches of rain total
1-1682	1-99	1-11-60	2:00 p.m.		2.2 inches of rain total
1-1683	1-90	1-12-60	9:30 a.m.	Wet	
1-1684	1-91	1-12-60	9:30 a.m.	Wet	
1-1685	1-92	1-12-60	9:15 a.m.	Wet	
1-1686	1-93	1-12-60	9:00 am.	Wet	
1-1687	1-94	1-12-60	9:00 a.m.		
1-1688	1-99	1-12-60	9:00 a.m.		
1-1689	1-90	1-13-60	10:55 a.m.	Wet	
1-1690	1-91	1-13-60	10:50 a.m.	Wet	
1-1691	1-92	1-13-60	10:40 a.m.	Wet	
1-1692	1-93	1-13-60	10:30 a.m.	Wet	
1-1693	1-94	1-13-60	10:45 a.m.	Wet	
1-1694	1-99	1-13-60	10:35 a.m.	Wet	
1-1695	2-52	1-13-60	11:10 a.m.	Wet	
1-1696	1-90	1-14-60	9:30 a.m.	Wet	3.9 inches rain total
1-1697	1-90	1-14-60	3:00 p.m.	Wet	4.2 inches of rain total
1-1698	1-91	1-14-60	9:30 a.m.	Wet	3.9 inches of rain total
1-1699	1-91	1-14-60	3:00 p.m.	Wet	4.2 inches of rain total

Slide No.	Manhole No.	Date	Time	Weather	Comments
1-1700	1-92	1-14-60	9:30 a.m.	Wet	3.9 inches of rain total
1-1701	1-92	1-14-60	2:50 p.m.	Wet	4.2 inches of rain total
1-1702	1-93	1-14-60	9:20 a.m.	Wet	3.9 inches of rain total
1-1703	1-93	1-14-60	2:45 p.m.	Wet	4.2 inches of rain total
1-1704	1-94	1-14-60	9:15 a.m.	Wet	3.9 inches of rain total
1-1705	1-94	1-14-60	2:45 p.m.	Wet	4.2 inches of rain total
1-1706	1-99	1-14-60	9:30 a.m.	Wet	3.9 inches of rain total
1-1707	1-99	1-14-60	2:50 p.m.	Wet	4.2 inches of rain total
1-1708	2-52	1-14-60	2:35 p.m.	Wet	
1-1709	1-90	1-14-60	2:30 p.m.	Dry	
1-1710	1-91	1-15-60	2:30 p.m.	Dry	
1-1711	1-92	1-15-60	2:30 p.m.	Dry	
1-1712	1-93	1-15-60	2:30 p.m.	Dry	
1-1713	1-94	1-15-60	2:30 p.m.	dry	
1-1714	1-99	1-15-60	2:30 p.m.	Dry	
1-1715	1-90	1-18-60	9:30 a.m.	Wet	
1-1716	1-91	1-18-60	9:30 a.m.	Wet	
1-1717	1-92	1-18-60	9:30 am.	Wet	
1-1718	1-93	1-18-60	9:30 a.m.	Wet	
1-1719	1-94	1-18-60	9:30 a.m.	Wet	
1-1720	1-99	1-18-60	9:30 a.m.	Wet	

Slide No.	Manhole No.	Date	Time	Weather	Comments
1-1721	1-91	1-21-60	2:30 p.m.	Wet	
1-1722	1-92	1-21-60	2:30 p.m.	Wet	
1-1723	1-93	1-21-60	2:30 p.m.	Wet	
1-1724	1-94	1-21-60	2:30 p.m.	Wet	
1-1725	1-99	1-21-60	2:30 p.m.	Wet	
1-1726	1-90	1-22-60	10:30 a.m.	Wet	
1-1727	1-91	1-22-60	10:30 a.m.	Wet	
1-1728	1-92	1-22-60	10:00 a.m.	Wet	
1-1729	1-93	1-22-60	10:00 a.m.	Wet	
1-1730	1-94	1-22-60	10:00 a.m.	Wet	
1-1731	1-99	1-22-60	10:00 a.m.	Wet	
1-1732	1-90	1-25-60	3:30 p.m.	Wet	
1-1733	1-91	1-25-60	3:30 p.m.	Wet	
1-1734	1-93	1-25-60	3:30 p.m.	Wet	
1-1735	1-94	1-25-60	3:30 p.m.	Wet	6.5 inches of rain total
1-1736	1-99	1-25-60	3:30 p.m.	Wet	6.5 inches of rain total
1-1737	2-52	1-25-60	3:00 p.m.		6.5 inches of rain total
1-1738	1-90	1-26-60	2:30 p.m.	Wet	
1-1739	1-91	1-26-60	2:30 p.m.	Wet	
1-1740	1-92	1-26-60	2:30 p.m.	Wet	
1-1741	1-93	1-26-60	2:30 p.m.	Wet	
1-1742	1-94	1-26-60	2:30 p.m.	Wet	
1-1743	1-94	1-26-60	2:30 p.m.	Wet	
1-1744	1-99	1-26-60	2:30 p.m.	Wet	

Slide No.	Manhole No.	Date	Time	Weather	Comments
1-1745	2-52	1-26-60	3:30 p.m.	Wet	
1-1746	1-90	1-27-60	3:00 p.m.	Wet	
1-1747	1-91	1-27-60	3:00 p.m.	Wet	
1-1748	1-92	1-27-60	3:00 p.m.	Wet	6.9 inches of rain total
1-1749	1-93	1-27-60	3:00 p.m.	Wet	
1-1750	1-94	1-27-60	3:00 p.m.	Wet	6.9 inches of rain total
1-1751	1-99	1-27-60	3:00 p.m.	Wet	6.9 inches of rain total
1-1752	2-52	1-27-60	3:30 p.m.	Wet	
1-1753	1-90	1-28-60	3:20 p.m.	Wet	
1-1754	1-91	1-28-60	2:30 p.m.	Wet	
1-1755	1-92	1-28-60	2:30 p.m.	Wet	
1-1756	1-93	1-28-60	2:30 p.m.	Wet	
1-1757	1-94	1-28-60	2:30 p.m.	Wet	
1-1758	1-99	1-28-60	2:30 p.m.	Wet	
1-1759	1-90	1-29-60	10:00 a.m.	Wet	
1-1760	1-91	1-29-60	10:00 a.m.	Wet	
1-1761	1-92	1-29-60	10:00 a.m.	Wet	
1-1762	1-93	1-29-60	10:00 a.m.	Wet	
1-1763	1-94	1-29-60	10:00 a.m.	Wet	
1-1764	1-99	1-29-60	10:00 a.m.	Wet	
1-1765	2-52	1-29-60	10:00 a.m.	Wet	11.3 inches of rain total
1-1766	1-90	2-1-60	2:30 p.m.	Wet	
1-1767	1-91	2-1-60	2:30 p.m.	Wet	
1-1768	1-92	2-1-60	2:30 p.m.	Wet	

Slide No.	Manhole No.	Date	Time	Weather	Comments
1-1769	1-93	2-1-60	2:30 p.m.	Wet	
1-1770	1-94	2-1-60	2:30 p.m.	Wet	
1-1771	1-99	2-1-60	2:30 p.m.	Wet	
1-1772	2-52	2-1-60	3:00 p.m.	Wet	
1-1774	1-90	2-2-60	3:00 p.m.	Wet	
1-1775	1-91	2-2-60	3:00 p.m.	Wet	
1-1776	1-92	2-2-60	3:00 p.m.	Wet	12.5 inches of rain total
1-1777	1-93	2-2-60	3:00 p.m.	Wet	
1-1778	1-94	2-2-60	3:00 p.m.	Wet	
1-1779	1-98	2-2-60	2:00 p.m.	Wet	
1-1780	1-99	2-2-60	3:00 p.m.	Wet	
1-1781	2-52	2-2-60	3:30 p.m.	Wet	
1-1782	1-91	2-3-60	3:00 p.m.	Wet	
1-1783	1-92	2-3-60	3:00 p.m.	Wet	
1-1784	1-93	2-3-60	3:00 p.m.	Wet	
1-1785	1-94	2-3-60	3:00 p.m.	Wet	
1-1786	1-99	2-3-60	3:00 p.m.	Wet	
1-1823	1-90	2-8-60	3:30 p.m.	Wet	
1-1824	1-91	2-8-60	3:30 p.m.	Wet	
1-1825	1-92	2-8-60	3:30 p.m.	Wet	
1-1826	1-93	2-8-60	3:30 p.m.	Wet	
1-1827	1-94	2-8-60	3:30 p.m.	Wet	
1-1828	1-91	2-9-60	10:30 a.m.	Wet	
1-1829	1-92	2-9-60	10:30 a.m.	Wet	
1-1830	1-93	2-9-60	10:30 a.m.	Wet	

Slide No.	Manhole No.	Date	Time	Weather	Comments
1-1831	1-94	2-9-60	10:30 a.m.	Wet	
1-1832	1-97	2-9-60	11:00 a.m.	Wet	
1-1833	1-98	2-9-60	10:30 a.m.	Wet	
1-1834	1-99	2-9-60	10:30 a.m.	Wet	
1-1835	1-99	2-9-60		Wet	
1-1851	1-64	2-11-60	3:45 p.m.	Wet	13.9 inches of rain total
1-1852	1-85	2-11-60	3:45 p.m.	Wet	
1-1853	1-86	2-11-60	3:45 p.m.	Wet	
1-1854	1-87	2-11-60	3:45 p.m.	Wet	
1-1855	1-88	2-11-60	3:45 p.m.	Wet	
1-1856	1-89	2-11-60	3:45 p.m.	Wet	
1-1857	1-90	2-11-60	3:15 p.m.	Wet	
1-1858	1-91	2-11-60	3:15 p.m.	Wet	
1-1859	1-92	2-11-60	3:15 p.m.	Wet	13.9 inches of rain total
1-1860	1-93	2-11-60	3:15 p.m.	Wet	13.9 inches of rain total
1-1861	1-94	2-11-60	3:15 p.m.	Wet	13.9 inches of rain total
1-1862	1-95	2-11-60	3:15 p.m.	Wet	
1-1863	1-96	2-11-60	3:15 p.m.	Wet	
1-1864	1-97	2-11-60	3:15 p.m.	Wet	
1-1865	1-99	2-11-60	3:15 p.m.	Wet	
1-1866	2-52	2-11-60	4:00 p.m.	Wet	
1-1867	1-64	2-24-60	2:00 p.m.	Wet	
1-1868	1-85	2-24-60	2:00 p.m.	Wet	
1-1869	1-86	2-24-60	2:00 p.m.	Wet	

Slide No.	Manhole No.	Date	Time	Weather	Comments
1-1870	1-87	2-24-60	2:00 p.m.	Wet	
1-1871	1-88	2-24-60	2:00 p.m.	Wet	
1-1872	1-89	2-24-60	2:00 p.m.	Wet	
1-1873	1-90	2-24-60	2:00 p.m.	Wet	
1-1874	1-91	2-24-60	2:00 p.m.	Wet	
1-1875	1-92	2-24-60	2:00 p.m.	Wet	
1-1876	1-93	2-24-60	2:00 p.m.	Wet	
1-1877	1-94	2-24-60	2:00 p.m.	Wet	
1-1878	1-95	2-24-60	2:00 p.m.	Wet	
1-1879	1-96	2-24-60	2:00 p.m.	Wet	
1-1880	1-97	2-24-60	2:00 p.m.	Wet	
1-1881	1-98	2-24-60	2:00 p.m.	Wet	
1-1882	1-99	2-24-60	2:00 p.m.	Wet	
1-1883	1-93	2-25-60	11:45 a.m.	Dry	
1-1884	1-94	2-25-60	11:45 a.m.	Dry	
1-1885	1-98	2-25-60	11:45 a.m.	Dry	
1-1901	1-85	2-25-60	1:30 p.m.	Dry	
1-1902	1-86	2-25-60	1:30 p.m.	Dry	
1-1903	1-87	2-25-60	1:30 p.m.	Dry	
1-1904	1-88	2-25-60	1:30 p.m.	Dry	
1-1905	1-89	2-25-60		Dry	
1-1906	1-90	2-25-60	11:45 a.m.	Dry	
1-1907	1-91	2-25-60	11:45 a.m.	Dry	
1-1908	1-92	2-25-60	11:45 a.m.	Dry	
1-1909	1-95	2-25-60	11:45 a.m.	Dry	
1-1910	1-96	2-25-60	11:45 a.m.	Dry	
1-1911	1-97	2-25-60	11:45 a.m.	Dry	

Slide No.	Manhole No.	Date	Time	Weather	Comments
1-1912	1-98	2-25-60	11:45 a.m.	Dry	
1-1913	1-99	2-25-60	11:45 a.m.	Dry	
1-1914	1-85	3-2-60			Weephole
1-1915	1-86	3-2-60			Weephole
1-1916	1-87	3-2-60			Weephole
1-1917	1-88	3-2-60			Weephole
1-1918	1-89	3-2-60			Weephole
1-1919	1-90	3-2-60			Weephole
1-1920	1-91	3-2-60			Weephole
1-1921	1-92	3-2-60			Weephole
1-1922	1-93	3-2-60			Weephole
1-1923	1-94	3-2-60			Weephole
1-1924	1-95	3-2-60			Weephole
1-1925	1-96	3-2-60			Weephole
1-1926	1-97	3-2-60			Weephole
1-1927	1-98	3-2-60			Weephole
1-1928	1-64	3-8-60	2:30 p.m.	Wet	
1-1929	1-85	3-8-60	2:30 p.m.	Wet	
1-1930	1-86	3-8-60		Wet	
1-1931	1-87	3-8-60	2:30 p.m.	Wet	
1-1932	1-88	3-8-60	2:30 p.m.	Wet	
1-1933	1-89	3-8-60	2:30 p.m.	Wet	
1-1934	1-90	3-8-60	2:30 p.m.	Wet	
1-1935	1-91	3-8-60	2:30 p.m.	Wet	
1-1936	1-92	3-8-60	2:30 p.m.	Wet	
1-1937	1-93	3-8-60	2:30 p.m.	Wet	

Slide No.	Manhole No.	Date	Time	Weather	Comments
1-1938	1-94	3-8-60	2:30 p.m.	Wet	
1-1939	1-96	3-8-60	2:30 p.m.	Wet	
1-1940	1-97	3-8-60	2:30 p.m.	Wet	
1-1941	1-98	3-8-60	2:30 p.m.	Wet	
1-1942	1-99	3-8-60	2:30 p.m.	Wet	
1-1943	2-52	3-8-60	2:45 p.m.	Wet	
1-1944	1-14	3-10-60	1:45 p.m.	Wet	
1-1945	1-15	3-10-60	1:45 p.m.	Wet	
1-1946	1-16	3-10-60	1:45 p.m.	Wet	
1-1947	1-17	3-10-60	1:45 p.m.	Wet	
1-1948	1-18	3-10-60	1:30 p.m.	Wet	
1-1949	1-21	3-10-60	2:00 p.m.	Wet	
1-1950	1-21	3-10-60	2:00 p.m.	Wet	
1-1951	1-24	3-10-60	2:15 p.m.	Wet	
1-1952	1-23	3-10-60	2:15 p.m.	Wet	
1-1953	1-25	3-10-60	2:15 p.m.	Wet	
1-1954	1-26	3-10-60	2:15 p.m.	Wet	
1-1955	1-27	3-10-60	2:30 p.m.	Wet	
1-1956	1-31	3-10-60	2:45 p.m.	Wet	
1-1957	1-32	3-10-60	2:45 p.m.	Wet	
1-1958	1-33	3-10-60	2:45 p.m.	Wet	
1-1959	1-36	3-10-60	2:45 p.m.	Wet	
1-1960	1-37	3-10-60	1:30 p.m.	Wet	
1-1961	1-38	3-10-60	1:30 p.m.	Wet	
1-1962	1-62	3-10-60	9:45 a.m.	Wet	
1-1963	1-63	3-10-60	11:00 a.m.	Wet	

Slide No.	Manhole No.	Date	Time	Weather	Comments
1-1964	1-65	3-10-60	11:15 a.m.	Wet	
1-1965	1-67	3-10-60	11:15 a.m.	Wet	
1-1966	1-68	3-10-60	11:15 a.m.	Wet	
1-1967	1-69	3-10-60	10:30 a.m.	Wet	
1-1968	1-70	3-10-60	10:45 a.m.	Wet	
1-1969	1-71	3-10-60	10:45 a.m.	Wet	
1-1970	1-72	3-10-60	10:45 a.m.	Wet	
1-1971	1-73	3-10-60	10:30 a.m.	Wet	
1-1972	1-74	3-10-60	10:15 a.m.	Wet	
1-1973	1-75	3-10-60	10:15 a.m.	Wet	
1-1974	1-77	3-10-60	10:45 a.m.	Wet	
1-1975	1-78	3-10-60	9:45 a.m.	Wet	
1-1976	1-79	3-10-60	10:00 a.m.	Wet	
1-1977	1-80	3-10-60	10:15 a.m.	Wet	
1-2002	1-90	10-3-60	2:15 p.m.		
1-2003	1-27	12-1-60	11:30 a.m.		
1-2004	1-28	12-1-60	11:17 a.m.	Wet	
1-2005	1-29	12-1-60	10:13 a.m.	Wet	
1-2006	1-64	12-1-60	10:48 a.m.	Wet	
1-2007	1-65	12-1-60	11:08 a.m.	Wet	
1-2008	1-66	12-1-60	11:03 a.m.	Wet	
1-2009	1-67	12-1-60	10:58 a.m.	Wet	
1-2010	1-68	12-1-60	10:55 a.m.	Wet	
1-2011	1-85	12-1-60	10:46 a.m.	Wet	
1-2012	1-86	12-1-60	10:42 a.m.	Wet	
1-2013	1-87	12-1-60	10:40 a.m.	Wet	

Slide No.	Manhole No.	Date	Time	Weather	Comments
1-2014	1-88	12-1-60	10:35 a.m.	Wet	
1-2015	1-89	12-1-60	10:28 a.m.	Wet	
1-2016	1-90	12-1-60	9:55 a.m.	Wet	
1-2017	1-90	12-1-60	2:14 p.m.	Wet	
1-2018	1-91	12-1-60	9:52 a.m.	Wet	
1-2019	1-91	12-1-60	2:20 p.m.	Wet	
1-2020	1-92	12-1-60	9:50 a.m.	Wet	
1-2021	1-92	12-1-60	2:23 p.m.	Wet	
1-2022	1-93	12-1-60	9:42 a.m.	Wet	
1-2023	1-93	12-1-60	1:55 p.m.	Wet	
1-2024	1-54	12-1-60	9:30 a.m.	Wet	
1-2025	1-94	12-1-60	1:51 p.m.	Wet	
1-2026	1-95	12-1-60	10:18 a.m.	Wet	
1-2027	1-96	12-1-60	10:13 a.m.	Wet	
1-2028	1-96	12-1-60	2:10 p.m.	Wet	
1-2029	1-97	12-1-60	10:08 a.m.	Wet	
1-2030	1-97	12-1-60	2:05 p.m.	Wet	
1-2031	1-98	12-1-60	10:06 a.m.	Wet	
1-2032	1-98	12-1-60	2:00 p.m.	Wet	
1-2033	1-99	12-1-60	9:46 a.m.	Wet	
1-2034	1-99	12-1-60	2:26 p.m.	Wet	
1-2035	1-64	12-1-60	2:40 p.m.	Wet	
1-2036	1-88	12-1-60	2:26 p.m.	Wet	
1-2037	1-89	12-1-60	2:30 p.m.	Wet	
1-2038	1-109	1-31-61		Wet	
1-2039	1-116	1-21-61		Wet	

Slide No.	Manhole No.	Date	Time	Weather	Comments
1-2040	1-127	1-31-61		Wet	
1-2041	1-131	1-31-61		Wet	
1-2042	1-132	1-31-61		Wet	
1-2043	1-133	1-31-61		Wet	
1-2044	1-134	1-31-61		Wet	
1-2045	1-14	1-30-61	9:35 a.m.		
1-2046	1-15	1-30-61	9:40 a.m.	Wet	
1-2047	1-16	1-30-61	9:40 a.m.	Wet	
1-2048	1-17	1-30-61	9:45 a.m.	Wet	
1-2049	1-18	1-30-61	9:45 a.m.	Wet	
1-2050	1-19	1-30-61	9:50 a.m.	Wet	
1-2051	1-21	1-30-61	10:00 a.m.	Wet	
1-2052	1-22	1-30-61	10:00 a.m.	Wet	
1-2053	1-23	1-30-61	10:05 a.m.	Wet	
1-2054	1-24	1-30-61	10:10 a.m.	Wet	
1-2055	1-25	1-30-61	10:10 a.m.	Wet	
1-2056	1-26	1-30-61	10:15 a.m.	Wet	
1-2057	1-27	1-30-61	10:20 a.m.	Wet	
1-2058	1-28	1-30-61	10:20 a.m.	Wet	
1-2059	1-29	1-30-61	10:25 a.m.	Wet	
1-2060	1-30	1-30-61	10:30 a.m.	Wet	
1-2061	1-31	1-30-61	10:30 a.m.	Wet	
1-2062	1-32	1-30-61	10:35 a.m.	Wet	
1-2063	1-33	1-30-61	10:35 a.m.	Wet	
1-2064	1-34	1-30-61	9:25 a.m.	Wet	

Slide No.	Manhole No.	Date	Time	Weather	Comment
1-2065	1-35	1-30-61	9:20 a.m.	Wet	
1-2066	1-36	1-30-61	9:20 a.m.	Wet	
1-2067	1-37	1-30-61	9:50 a.m.	Wet	
1-2068	1-38	1-30-61	9:55 a.m.	Wet	
1-2069	1-62	1-30-61		Wet	
1-2070	1-63	1-30-61		Wet	
1-2071	1-64	1-30-61	10:55 a.m.	Wet	
1-2072	1-65	1-30-61	10:40 a.m.	Wet	
1-2073	1-66	1-30-61	10:45 a.m.	Wet	
1-2074	1-67	1-30-61	10:45 a.m.	Wet	
1-2075	1-68	1-30-61	10:50 a.m.	Wet	
1-2076	1-69	1-30-61		Wet	
1-2077	1-70	1-30-61		Wet	
1-2078	1-71	1-30-61		Wet	
1-2079	1-72	1-30-61		Wet	
1-2080	1-73	1-30-61		Wet	
1-2081	1-74	1-30-61		Wet	
1-2082	1-75	1-30-61		Wet	
1-2083	1-76	1-30-61		Wet	
1-2084	1-77	1-30-61		Wet	
1-2085	1-78	1-30-61		Wet	
1-2086	1-79	1-30-61		Wet	
1-2087	1-80	1-30-61		Wet	
1-2088	1-81	1-30-61		Wet	
1-2089	1-82	1-30-61		Wet	

Slide No.	Manhole No.	Date	Time	Weather	Comments
1-2090	1-83	1-30-61		Wet	
1-2091	1-84	1-30-61		Wet	
1-2092	1-85	1-30-61	10:55 a.m.	Wet	
1-2093	1-86	1-30-61	11:00 a.m.	Wet	
1-2094	1-87	1-30-61	11:00 a.m.	Wet	
1-2095	1-88	1-30-61	11:05 a.m.	Wet	
1-2096	1-89	1-30-61	11:10 a.m.	Wet	
1-2097	1-90	1-30-61	11:10 a.m.	Wet	
1-2098	1-91	1-30-61	11:10 a.m.	Wet	
1-2099	1-92	1-30-61	11:15 a.m.	Wet	
1-2100	1-93	1-30-61	11:20 a.m.	Wet	
1-2101	1-94	1-30-61	11:20 a.m.	Wet	
1-2102	1-95	1-30-61	11:25 a.m.	Wet	
1-2103	1-96	1-30-61	11:25 a.m.	Wet	
1-2104	1-97	1-30-61	11:25 a.m.	Wet	
1-2105	1-98	1-30-61	11:30 a.m.	Wet	
1-2106	1-99	1-30-61	11:15 a.m.	Wet	
1-2107	1-102	1-30-61		Wet	
1-2108	1-102	1-30-61		Wet	
1-2109	1-103	1-30-61		Wet	
1-2110	1-104	1-30-61		Wet	
1-2111	1-106	1-30-61		Wet	
1-2112	1-107	1-30-61		Wet	
1-2113	1-108	1-30-61		Wet	
1-2114	1-109	1-30-61		Wet	
1-2115	1-110	1-30-61		Wet	

Slide No.	Manhole No.	Date	Time	Weather	Comments
1-2116	1-111	1-30-61		Wet	
1-2117	1-112	1-30-61		Wet	
1-2118	1-113	1-30-61		Wet	
1-2119	1-114	1-30-61		Wet	
1-2120	1-115	1-30-61		Wet	
1-2121	1-116	1-30-61		Wet	
1-2124	1-119	1-30-61	1:10 p.m.	Wet	
1-2122	1-117	1-30-61		Wet	
1-2123	1-118	1-30-61		Wet	
1-2125	1-120	1-30-61	1:15 p.m.	Wet	
1-2126	1-121	1-30-61	1:15 p.m.	Wet	
1-2127	1-122	1-30-61	1:35 p.m.	Wet	
1-2128	1-123	1-30-61	1:45 p.m.	Wet	
1-2129	1-124	1-30-61	1:45 p.m.	Wet	
1-2130	1-125	1-30-61	1:40 p.m.	Wet	
1-2131	1-127	1-30-61		Wet	
1-2132	1-128	1-30-61	2:15 p.m.	Wet	
1-2133	1-129	1-30-61	2:10 p.m.	Wet	
1-2134	1-131	1-30-61	1:50 p.m.	Wet	
1-2139	1-136	1-30-61		Wet	
1-2140	1-137	1-30-61		Wet	
1-2141	94	2-2-61		Wet	
1-2142	99	2-2-61		Wet	
1-2179	1-97	1-17-61	10:15 a.m.	Wet	
1-2180	1-67	3-17-61	10:05 a.m.	Wet	
1-2181	1-68	3-17-61	10:10 a.m.	Wet	

Slide No.	Manhole No.	Date	Time	Weather	Comments
1-2182	1-86	3-17-61	11:15 a.m.		
1-2183	1-90	3-17-61	10:15 a.m.	Wet	
1-2184	1-94	3-17-61	11:00 a.m.	Wet	
1-2185	1-98	3-17-61	10:25 a.m.	Wet	
1-2186	1-109	3-17-61	10:30 a.m.	Wet	
1-2187	1-127	3-17-61	10:50 a.m.	Wet	
1-2188	1-99	3-17-61	11:10 a.m.	Wet	
1-2189	1-105	3-27-61	9:55 a.m.	Wet	
1-2190	1-119	3-27-61	10:10 a.m.	Wet	
1-2191	1-121	3-27-61	10:10 a.m.	Wet	
1-2192	1-123	3-27-61	10:15 a.m.	Wet	
1-2193	1-124	3-27-61	10:20 a.m.	Wet	
1-2194	1-125	3-27-61	10:25 a.m.	Wet	
1-2202	1-16	3-17-61	10:00 a.m.	Wet	
1-2203	1-23	3-17-61	10:00 a.m .	Wet	
1-2206	1-16	3-27-61	11:30 a.m.	Wet	
1-2207	1-68	3-27-61	11:25 a.m.	Wet	
1-2208	1-90	3-27-61	11:10 a.m.	Wet	
1-2209	1-127	3-27-61	10:35 a.m.	Wet	
1-2210	1-128	3-27-61	10:40 a.m.	Wet	
1-2211	1-131	3-27-61	10:45 a.m.	Wet	
1-2212	1-132	3-27-61	10:55 a.m.	Wet	
1-2213	1-133	3-27-61	10:45 a.m.	Wet	
1-2214	1-134	3-27-61	11:00 a.m.	Wet	
1-2215	1-135	3-27-61	11:00 a.m.	Wet	
1-2216	67	4-10-61		Dry	Second RS-1 treatment

Slide No.	Manhole No.	Date	Time	Weather	Comments
1-2217	67	4-10-61		Dry	Second RS-1 treatment
1-2218	24	4-10-61		Dry	
1-2219	22	5-16-61		Dry	After SC-1 treatment
1-2220	22	5-16-61			After SC-1 treatment
1-2221	22	5-16-61			After SC-1 treatment
1-2222	90-1	6-15-61		Dry	During SC-1 treatment
1-2223	T-48	10-25-61	10:15 a.m.	Dry	
1-2224	T-49	10-25-61	10:20 a.m.	Dry	
1-2225	T-50	10-25-61	10:20 a.m.	Dry	
1-2226	T-51	10-25-61	11:30 a.m.	Dry	
1-2227	T-52A	10-25-61	11:20 a.m.	Dry	
1-2228	T-53	10-25-61	1:20 p.m.	Dry	
1-2229	T-56	10-25-61	1:50 p.m.	Dry	
1-2279	1-60	10-26-61	2:45 p.m.	Dry	
1-2230	T-57	10-25-61	2:05 p.m.	Dry	
1-2231	T-58	10-25-61	2:10 p.m.	Dry	
1-2232	T-59	10-25-61	2:50 p.m.	Dry	
1-2233	T-60	10-25-61	3:40 p.m.	Dry	
1-2234	T-62	10-25-61	3:35 p.m.	Dry	
1-2235	T-63	10-25-61	3:30 p.m.	Dry	
1-2236	T-64	10-25-61	3:50 p.m.	Dry	
1-2237	T-65	10-26-61	2:15 p.m.	Dry	
1-2238	T-66	10-26-61	2:20 p.m.	Dry	
1-2239	T-67	10-26-61	2:30 p.m.	Dry	
1-2240	T-68	10-26-61	3:00 p.m.	Dry	
1-2241	T-69	10-26-61	3:15 p.m.	Dry	

Slide No.	Manhole No.	Date	Time	Weather	Comments
1-2242	T-69A	10-26-61	3:20 p.m.	Dry	
1-2243	T-70	10-26-61	3:30 p.m.	Dry	
1-2244	T-71	10-26-61	3:30 p.m.	Dry	
1-2245	T-72	10-27-61	2:40 p.m.	Dry	
1-2246	T-73	10-27-61	2:45 p.m.	Dry	
1-2247	T-74	10-27-61	3:00 p.m.	Dry	
1-2248	T-75	10-27-61	3:00 p.m.	Dry	
1-2249	T-75B	10-27-61	3:00 p.m.	Dry	
1-2250	T-75B1	10-27-61	3:10 p.m.	Dry	
1-2251	T75C	10-27-61	3:05 p.m.	Dry	
1-2252	T-76	10-27-61	3:15 p.m.	Dry	
1-2253	1-1	10-25-61	10:30 a.m.	Dry	
1-2254	1-2	10-25-61	10:30 a.m.	Dry	
1-2255	1-3	10-25-61	10:40 a.m.	Dry	
1-2256	1-9	10-25-61	11:10 a.m.	Dry	
1-2257	1-10	10-25-61	10:50 a.m.	Dry	
1-2258	1-11	10-25-61	10:50 a.m.	Dry	
1-2259	1-12	10-25-61	11:00 a.m.	Dry	
1-2260	1-39	10-25-61	11:05 a.m.	Dry	
1-2261	1-40	10-25-61	2:20 p.m.	Dry	
1-2262	1-42	10-25-61	2:00 p.m.	Dry	
1-2263	1-43	10-25-61	2:35 p.m.	Dry	
1-2264	1-44	10-25-61	2:40 p.m.	Dry	
1-2265	1-45	10-25-61	2:45 p.m.	Dry	
1-2266	1-47	10-25-61	3:45 p.m.	Dry	
1-2267	1-48	10-25-61	3:25 p.m.	Dry	

Slide No.	Manhole No.	Date	Time	Weather	Comments
1-2268	1-49	10-25-61	3:30 p.m.	Dry	
1-2269	1-49A	10-25-61	3:00 p.m.	Dry	
1-2270	1-50	10-25-61	2:55 p.m.	Dry	
1-2271	1-52	10-25-61	4:00 p.m.	Dry	
1-2272	1-53	10-26-61	2:20 p.m.	Dry	
1-2273	1-54	10-26-61	2:25 p.m.	Dry	
1-2274	1-55	10-26-61	3:10 p.m.	Dry	
1-2275	1-56	10-26-61	3:00 p.m.	Dry	
1-2276	1-57	10-26-61	3:05 p.m.	Dry	
1-2277	1-58	10-26-61	3:05 p.m.	Dry	
1-2278	1-59	10-26-61	3:05 p.m.	Dry	
1-2279	1-60	10-26-61	2:45 p.m.	Dry	
1-2280	1-61	10-26-61	1:30 p.m.	Dry	
1-2281	1-62	10-20-61	11:00 a.m.	Dry	
1-2282	1-63	10-20-61	10:30 a.m.	Dry	
1-2283	1-69	10-20-61	1:25 p.m.	Dry	
1-2284	1-70	10-20-61	1:35 p.m.	Dry	
1-2285	1-71	10-20-61	1:40 p.m.	Dry	
1-2286	1-72	10-20-61	1:40 p.m.	Dry	
1-2287	1-73	10-20-61	1:25 p.m.	Dry	
1-2288	1-74	10-20-61	1:15 p.m.	Dry	
1-2289	1-75	10-20-61	1:30 p.m.	Dry	
1-2290	1-76	10-20-61	10:00 a.m.	Dry	
1-2291	1-77	10-20-61	10:00 a.m.	Dry	
1-2292	1-78	10-20-61	10:40 a.m.	Dry	

Slide No.	Manhole No.	Date	Time	Weather	Comments
1-2293	1-79	10-20-61	10:45 a.m.	Dry	
1-2294	1-80	10-20-61	1:10 p.m.	Dry	
1-2295	1-81	10-20-61	10:10 a.m.	Dry	
1-2296	1-82	10-20-61	10:10 a.m.	Dry	
1-2297	1-83	10-20-61	10:30 a.m.	Dry	
1-2298	1-84	10-20-61	10:30 a.m.	Dry	
1-2299	1-100	10-27-61	2:30 p.m.	Dry	
1-2300	1-101	10-27-61	2:20 p.m.	Dry	
1-2301	1-102	10-20-61	1:50 p.m.	Dry	
1-2302	1-103	10-20-61	1:50 p.m.	Dry	
1-2303	1-104	10-20-61	3:55 p.m.	Dry	
1-2304	1-106	10-20-61	1:45 p.m.	Dry	
1-2305	1-107	10-20-61	1:45 p.m.	Dry	
1-2306	1-108	10-20-61	2:00 p.m.	Dry	
1-2307	1-109	10-20-61	2:00 p.m.	Dry	
1-2308	1-110	10-20-61	2:10 p.m.	Dry	
1-2309	1-111	10-20-61	3:55 p.m.	Dry	
1-2310	1-112	10-20-61	3:20 p.m.	Dry	
1-2311	1-113	10-20-61	3:00 p.m.	Dry	
1-2312	1-114	10-20-61	3:20 p.m.	Dry	
1-2313	1-115	10-20-61	2:20 p.m.	Dry	
1-2314	1-116	10-20-61	2:25 p.m.	Dry	
1-2315	1-117	10-20-61	3:20 p.m.	Dry	
1-2316	1-118	10-20-61	3:25 p.m.	Dry	
1-2317	1-119	10-20-61	3:30 p.m.	Dry	
1-2318	1-120	10-20-61	3:30 p.m.	Dry	

Slide No.	Manhole No.	Date	Time	Weather	Comments
1-2319	1-121	10-20-61	3:40 p.m.	Dry	
1-2320	1-122	10-20-61	3:00 p.m.	Dry	
1-2321	1-123	10-20-61	3:10 p.m.	Dry	
1-2322	1-124	10-20-61	3:15 p.m.	Dry	
1-2323	1-125	10-20-61	3:00 p.m.	Dry	
1-2324	1-127	10-20-61	2:15 p.m.	Dry	
1-2325	1-128	10-20-61	2:30 p.m.	Dry	
1-2326	1-129	10-20-61	2:30 p.m.	Dry	
1-2327	1-131	10-20-61	2:40 p.m.	Dry	
1-2328	1-132	10-20-61	2:45 p.m.	Dry	
1-2329	1-133	10-20-61	1:40 p.m.	Dry	
1-2330	1-134	10-20-61	1:40 p.m.	Dry	
1-2331	1-135	10-20-61	2:50 p.m.	Dry	
1-2332	1-136	10-20-61	4:00 p.m.	Dry	
1-2333	1-137	10-20-61	4:05 p.m.	Dry	
1-2334	1-137A	10-27-61	2:55 p.m.	Dry	
1-2335	1-137B	10-27-61	2:50 p.m.	Dry	
1-2336	1-138	10-23-61	2:55 p.m.	Dry	
1-2337	1-139	10-25-61	1:10 p.m.	Dry	
1-2338	1-140	10-23-61	3:10 p.m.	Dry	
1-2359	1-141	10-23-61	2:35 p.m.	Dry	
1-2340	1-142	10-23-61	2:40 p.m.	Dry	
1-2341	1-143	10-23-61	2:45 p.m.	Dry	
1-2342	1-151	10-31-61	11:25 a.m.	Dry	
1-2343	1-4	10-31-61	10:35 a.m.	Dry	
1-2344	1-5	10-31-61	11:00 a.m.	Dry	

Slide No.	Manhole No.	Date	Time	Weather	Comments
1-2349	1-147	11-31-61	11:10 a.m.	Dry	
1-2350	1-148	10-31-61	11:15 a.m.	Dry	
1-2351	1-149	10-31-61	11:20 a.m.	Dry	
1-2352	1-150	10-31-61	11:20 a.m.	Dry	
1-2353	1-152	10-31-61	11:30 a.m.	Dry	
1-2354	1-153	10-31-61	11:00 a.m.	Dry	
1-2355	1-154	10-31-61	11:35 a.m.	Dry	
1-2356	1-157	10-31-61	11:35 a.m.	Dry	
1-2357	1-7	10-31-61	11:40 a.m.	Dry	
1-2358	1-14	11-8-61	9:00 a.m.	Dry	
1-2359	1-15	11-8-61	9:00 a.m.	Dry	
1-2360	1-16	11-8-61	9:05 a.m.	Dry	
1-2361	1-17	11-8-61	9:10 a.m.	Dry	
1-2362	1-18	11-8-61	9:10 a.m.	Dry	
1-2363	1-19	11-8-61	9:15 a.m.	Dry	
1-2364	1-20	11-8-61	1:35 p.m.	Dry	
1-2365	1-21	11-8-61	11:45 a.m.	Dry	
1-2366	1-22	11-8-61	11:35 a.m.	Dry	
1-2367	1-23	11-8-61	11:35 a.m.	Dry	
1-2368	1-24	11-8-61	11:30 a.m.	Dry	
1-2369	1-25	11-8-61	11:30 a.m.	Dry	
1-2370	1-26	11-8-61	11:10 a.m.	Dry	
1-2371	1-27	11-8-61	11:10 a.m.	Dry	
1-2372	1-28	11-8-61	11:15 a.m.	Dry	
1-2373	1-29	11-8-61	9:20 a.m.	Dry	
1-2374	1-30	11-8-61	9:25 a.m.	Dry	

Slide No.	Manhole No.	Date	Time	Weather	Comments
1-2375	1-31	11-8-61	11:25 a.m.	Dry	
1-2376	1-32	11-8-61	11:25 a.m.	Dry	
1-2377	1-33	11-8-61	11:20 a.m.	Dry	
1-2378	1-34	11-8-61	8:45 a.m.	Dry	
1-2379	1-35	11-8-61	8:45 a.m.	Dry	
1-2380	1-36	11-8-61	8:40 a.m.	Dry	
1-2381	1-37	11-8-61	11:15 a.m.	Dry	
1-2382	1-38	11-8-61	9:15 a.m.	Dry	
1-2383	1-46	11-8-61	1:55 p.m.	Dry	
1-2384	1-64	11-8-61	10:20 a.m.	Dry	
1-2385	1-65	11-8-61	10:15 a.m.	Dry	
1-2386	1-66	11-8-61	10:05 a.m.	Dry	
1-2387	1-67	11-8-61	10:05 a.m.	Dry	
1-2388	1-68	11-8-61	10:00 a.m.	Dry	
1-2389	1-85	11-8-61	10:25 a.m.	Dry	
1-2390	1-86	11-8-61	10:30 a.m.	Dry	
1-2391	1-87	11-8-61	10:30 a.m.	Dry	
1-2392	1-88	11-8-61	10:35 a.m.	Dry	
1-2393	1-89	11-8-61	10:40 a.m.	Dry	
1-2394	1-90	11-8-61	9:35 a.m.	Dry	
1-2395	1-91	11-8-61	9:50 a.m.	Dry	
1-2396	1-92	11-8-61	9:50 a.m.	Dry	
1-2397	1-93	11-8-61	9:35 a.m.	Dry	
1-2398	1-94	11-8-61	9:30 a.m.	Dry	
1-2399	1-95	11-8-61	9:45 a.m.	Dry	
1-2400	1-96	11-8-61	9:45 a.m.	Dry	

Slide No.	Manhole No.	Date	Time	Weather	Comments
1-2401	1-97	11-8-61	9:40 a.m.	Dry	
1-2402	1-98	11-8-61	9:35 a.m.	Dry	
1-2403	1-99	11-8-61	9:50 a.m.	Dry	
1-2404	1-155	10-31-61	11:45 a.m.	Dry	
1-2405	T-60	11-8-61	2:00 p.m.	Dry	
1-2419	2-38	12-1-61	1:15 p.m.	Wet	
1-2420	2-40	12-1-61	1:20 p.m.	Wet	
1-2421	2-43	12-1-61	1:45 p.m.	Wet	
1-2422	2-44	12-1-61	1:40 p.m.	Wet	
1-2423	2-52	12-1-61	1:45 p.m.	Wet	
1-2424	T-71	12-1-61	10:20 a.m.	Wet	
1-2425	T-71	12-1-61		Wet	
1-2426	T-71	2-7-62	10:40 a.m.	Wet	
1-2427	T-71	2-9-62	9:00 a.m.	Wet	
1-2428	T-67	2-14-62	2:50 p.m.	Wet	
1-2433	1-51	11-8-61	2:15 p.m.	Dry	
1-2434	1-66	12-1-61		Wet	Asphalt sealing complete
1-2435	60A	12-1-61		Wet	
1-2436	1-61	12-1-61	10:30 a.m.	Wet	
1-2437	1-61	12-1-61	10:30 a.m.	Wet	
1-2438	1-77	12-1-61	11:00 a.m.	Wet	
1-2439	1-15	2-7-62	9:15 a.m.	Wet	
1-2440	1-19	2-7-62	9:20 a.m.	Wet	
1-2441	1-16	2-7-62	9:20 a.m.	Wet	
1-2442	1-27	2-7-62	9:30 a.m.	Wet	

Slide No.	Manhole No.	Date	Time	Weather	Comments
1-2443	1-31	2-7-62	9:30 a.m.	Wet	
1-2444	1-24	2-7-62	9:35 a.m.	Wet	
1-2445	1-14	2-7-62	9:40 a.m.	Wet	
1-2446	1-21	2-7-62	9:40 a.m.	Wet	
1-2447	1-36	2-7-62	9:10 a.m.	Wet	
1-2448	1-66	2-7-62	9:45 a.m.	Wet	
1-2449	1-67	2-7-62	9:50 a.m.	Wet	
1-2450	1-93	2-7-62	9:55 a.m.	Wet	
1-2451	1-92	2-7-62	10:05 a.m.	Wet	
1-2452	1-97	2-7-62	10:10 a.m.	Wet	
1-2453	1-90	2-7-62	10:10 a.m.	Wet	
1-2454	1-88	2-7-62	10:15 a.m.	Wet	
1-2455	1-64	2-7-62	10:20 a.m.	Wet	
1-2456	1-61	2-7-62	10:25 a.m.	Wet	
1-2457	1-62	2-7-62	10:25 a.m.	Wet	
1-2458	1-77	2-7-62	10:30 a.m.	Wet	
1-2459	1-60A	2-7-62	10:45 a.m.	Wet	
1-2460	1-17	2-7-62	11:00 a.m.	Wet	
1-2461	1-18	2-7-62	11:05 a.m.	Wet	
1-2462	1-37	2-7-62	11:10 a.m.	Wet	
1-2463	1-28	2-7-62	11:10 a.m.	Wet	
1-2464	1-33	2-7-62	11:15 a.m.	Wet	
1-2465	1-23	2-7-62	11:25 a.m.	Wet	
1-2466	T-76	2-7-62	11:35 a.m.	Wet	
1-2467	1-105	11-8-61	2:27 p.m.	Dry	
1-2468	1-60A	2-9-62	9:10 a.m.	Wet	

Slide No.	Manhole No.	Date	Time	Weather	Comments
1-2469	1-61	2-9-62	9:40 a.m.	Wet	
1-2470	1-69	2-9-62	9:45 a.m.	Wet	
1-2471	1-74	2-9-62	9:47 a.m.	Wet	
1-2472	1-73	2-9-62	9:50 a.m.	Wet	
1-2473	1-75	2-9-62	9:55 a.m.	Wet	
1-2474	1-70	2-9-62	10:05 a.m.	Wet	
1-2475	1-71	2-9-62	10:08 a.m.	Wet	
1-2476	1-72	2-9-62	10:12 a.m.	Wet	
1-2477	1-76	2-9-62	10:45 a.m.	Wet	
1-2478	1-77	2-9-62	10:55 a.m.	Wet	
1-2479	1-78	2-9-62	11:00 a.m.	Wet	
1-2480	1-62	2-9-62	11:10 a.m.	Wet	Manhole 1-76 test plugged
1-2481	1-62	2-9-62	11:10 a.m.	Wet	Manhole test plugged
1-2482	1-19	2-9-62	1:45 p.m.	Wet	
1-2483	1-90	2-9-62	1:50 p.m.	Wet	
1-2484	1-86	2-9-62	2:00 p.m.	Wet	
1-2485	1-86	2-12-62	1:32 p.m.	Wet	
1-2486	1-90	2-12-62	1:48 p.m.	Wet	
1-2487	1-89	2-12-62	1:45 p.m.	Wet	
1-2488	1-111	2-12-62	4:00 p.m.	Wet	
1-2489	1-64	2-12-62	12:45 p.m.	Wet	
1-2490	1-85	2-13-62	12:50 p.m.	Wet	
1-2491	1-86	2-13-62	12:50 p.m.	Wet	
1-2492	1-87	2-13-62	1:00 p.m.	Wet	
1-2493	1-88	2-13-62	1:00 p.m.	Wet	

Slide No.	Manhole No.	Date	Time	Weather	Comments
1-2494	1-89	2-13-62	1:05 p.m.	Wet	
1-2495	1-90	2-13-62	1:10 p.m.	Wet	
1-2496	1-99	2-13-62		Wet	
1-2497	1-68	2-13-62	1:20 p.m.	Wet	
1-2498	1-67	2-13-62	1:20 p.m.	Wet	
1-2499	1-66	2-13-62	1:25 p.m.	Wet	
1-2500	1-65	2-13-62	1:30 p.m.	Wet	
1-2501	1-25	2-13-62	1:40 p.m.	Wet	
1-2502	1-84	2-13-62	2:40 p.m.	Wet	
1-2503	1-27	2-13-62	1:40 p.m.	Wet	
1-2504	1-26	2-13-62	1:40 p.m.	Wet	
1-2505	1-63	2-13-62	2:45 p.m.	Wet	
1-2506	1-28	2-13-62	1:45 p.m.	Wet	
1-2507	1-38	2-13-62	2:00 p.m.	Wet	
1-2508	1-63	2-14-62	2:22 p.m.	Wet	
1-2509	1-62	2-14-62	2:25 p.m.	Wet	
1-2510	1-61	2-14-62	2:28 p.m.	Wet	
1-2511	1-29	2-13-62	1:50 p.m.	Wet	
1-2512	1-62	2-13-62	1:50 p.m.	Wet	
1-2513	1-76	2-13-62	1:55 p.m.	Wet	
1-2514	1-30	2-13-62	1:55 p.m.	Wet	
1-2515	1-77	2-13-62	2:00 p.m.	Wet	
1-2516	1-81	2-13-62	2:00 p.m.	Wet	
1-2517	1-82	2-13-62	2:00 p.m.	Wet	
1-2518	1-19	2-13-62	2:00 p.m.	Wet	
1-2519	1-18	2-13-62	2:00 p.m.	Wet	

Slide No.	Manhole No.	Date	Time	Weather	Comments
1-2520	1-37	2-13-62	2:05 p.m.	Wet	
1-2521	1-17	2-13-62	2:05 p.m.	Wet	
1-2522	1-16	2-13-62	2:10 p.m.	Wet	
1-2523	1-97	2-13-62	2:10 p.m.	Wet	
1-2524	1-98	2-13-62	2:10 p.m.	Wet	
1-2525	1-15	2-13-62	2:15 p.m.	Wet	
1-2526	1-93	2-13-62	2:15 p.m.	Wet	
1-2527	1-94	2-13-62	2:20 p.m.	Wet	
1-2528	1-19A	2-13-62	2:20 p.m.	Wet	
1-2529	1-36	2-13-62	2:25 p.m.	Wet	
1-2530	1-96	2-13-62	2:25 p.m.	Wet	
1-2531	1-95	2-13-62	2:30 p.m.	Wet	
1-2532	1-14	2-13-62	2:30 p.m.	Wet	
1-2533	1-21	2-13-62	2:35 p.m.	Wet	
1-2534	1-83	2-13-62	2:40 p.m.	Wet	
1-2535	1-24	2-13-62	2:40 p.m.	Wet	
1-2536	1-23	2-13-62	2:45 p.m.	Wet	
1-2537	1-22	2-13-62	2:45 p.m.	Wet	
1-2538	1-102	2-13-62	2:50 p.m.	Wet	
1-2539	1-31	2-13-62	2:50 p.m.	Wet	
1-2540	1-103	2-13-62	2:50 p.m.	Wet	
1-2541	1-32	2-13-62	2:55 p.m.	Wet	
1-2542	1-33	2-13-62	3:00 p.m.	Wet	
1-2543	1-108	2-13-62	3:00 p.m.	Wet	
1-2544	1-109	2-13-62	3:00 p.m.	Wet	
1-2545	1-60A	2-13-62	3:05 p.m.	Wet	

Slide No.	Manhole No.	Date	Time	Weather	Comments
1-2546	1-110	2-13-62	3:05 p.m.	Wet	
1-2547	1-106	2-13-62	3:10 p.m.	Wet	
1-2548	1-107	2-13-62	3:10 p.m.	Wet	
1-2549	1-104	2-13-62	3:15 p.m.	Wet	
1-2550	1-136	2-13-62	3:15 p.m.	Wet	
1-2551	1-137	2-13-62	3:20 p.m.	Wet	
1-2552	2-71	2-13-62	3:20 p.m.	Wet	
1-2553	1-112	2-13-62	4:05 p.m.	Wet	
1-2554	1-113	2-13-62	4:10 p.m.	Wet	
1-2556	1-115	2-13-62	4:15 p.m.	Wet	
1-2557	1-116	2-13-62	4:15 p.m.	Wet	
1-2558	1-64	2-14-62	1:30 p.m.	Wet	
1-2559	1-86	2-14-62	1:34 p.m.	Wet	
1-2560	1-87	2-14-62	1:36 p.m.	Wet	
1-2561	1-88	2-14-62	1:40 p.m.	Wet	
1-2562	1-95	2-14-62	1:51 p.m.	Wet	
1-2563	1-92	2-14-62	1:57 p.m.	Wet	
1-2564	1-99	2-14-62	2:01 p.m.	Wet	
1-2565	1-93	2-14-62	2:05 p.m.	Wet	
1-2566	1-94	2-14-62	2:07 p.m.	Wet	
1-2567	1-98	2-14-62	2:12 p.m.	Wet	
1-2568	1-96	2-14-62	2:17 p.m.	Wet	
1-2569	1-97	2-14-62	2:15 p.m.	Wet	
1-2570	1-64	2-14-62	2:32 p.m.	Wet	
1-2573	1-91	2-14-62	1:55 p.m.	Wet	
1-2574	1-64	2-15-62	1:20 p.m.	Wet	

Slide No.	Manhole No.	Date	Time	Weather	Comments
1-2575	1-85	2-15-62	1:25 p.m.	Wet	
1-2576	1-86	2-15-62	1:30 p.m.	Wet	
1-2577	1-87	2-15-62	1:30 p.m.	Wet	
1-2578	1-88	2-15-62	1:35 p.m.	Wet	
1-2579	1-89	2-15-62	1:40 p.m.	Wet	
1-2580	1-90	2-15-62	1:45 p.m.	Wet	
1-2581	1-91	2-15-62	1:45 p.m.	Wet	
1-2582	1-92	2-15-62	1:55 p.m.	Wet	
1-2583	1-99	2-15-62	2:00 p.m.	Wet	
1-2584	1-94	2-15-62	2:00 p.m.	Wet	
1-2585	1-93	2-15-62	2:05 p.m.	Wet	
1-2586	1-97	2-15-62	2:10 p.m.	Wet	
1-2587	1-98	2-15-62	2:10 p.m.	Wet	
1-2588	1-31	2-15-62	2:15 p.m.	Wet	
1-2589	1-96	2-15-62	2:15 p.m.	Wet	
1-2590	1-95	2-15-62	2:20 p.m.	Wet	
1-2591	1-92	2-15-62	2:30 p.m.	Wet	
1-2592	1-81	2-15-62	2:35 p.m.	Wet	
1-2593	1-77	2-15-62	2:45 p.m.	Wet	
1-2594	1-62	2-15-62	2:50 p.m.	Wet	
1-2595	1-76	2-15-62	2:50 p.m.	Wet	
1-2596	1-67	2-15-62	3:00 p.m.	Wet	
1-2597	1-68	2-15-62	3:10 p.m.	Wet	
1-2598	1-66	2-15-62	3:10 p.m.	Wet	
1-2599	1-23	2-15-62	3:15 p.m.	Wet	
1-2600	1-24	2-15-62	3:15 p.m.	Wet	

Slide No.	Manhole No.	Date	Time	Weather	Comments
1-2601	1-32	2-15-62	3:20 p.m.	Wet	
1-2602	1-27	2-15-62	3:30 p.m.	Wet	
1-2603	1-33	2-15-62	3:30 p.m.	Wet	
1-2604	1-28	2-15-62	3:35 p.m.	Wet	
1-2605	1-29	2-15-62	3:35 p.m.	Wet	
1-2606	1-19	2-15-62	3:40 p.m.	Wet	
1-2607	1-17	2-15-62	3:45 p.m.	Wet	
1-2608	1-18	2-15-62	3:45 p.m.	Wet	
1-2609	1-93	2-16-62	2:40 p.m.	Wet	
1-2610	1-96	2-16-62	2:45 p.m.	Wet	
1-2611	1-97	2-16-62	2:45 p.m.	Wet	
1-2612	1-98	2-16-62	2:45 p.m.	Wet	
1-2613	1-29	2-16-62	2:55 p.m.	Wet	
1-2614	1-28	2-16-62	3:00 p.m.	Wet	
1-2615	1-27	2-16-62	3:00 p.m.	Wet	
1-2616	1-26	2-16-62	3:05 p.m.	Wet	
1-2617	1-24	2-16-62	3:15 p.m.	Wet	
1-2618	1-25	2-16-62	3:15 p.m.	Wet	
1-2619	1-32	2-16-62	3:20 p.m.	Wet	
1-2620	1-33	2-16-62	3:20 p.m.	Wet	
1-2621	1-19	2-16-62	3:25 p.m.	Wet	
1-2622	1-12	2-16-62	3:30 p.m.	Wet	
1-2623	1-16	2-16-62	3:30 p.m.	Wet	
1-2624	1-21	2-16-62	3:30 p.m.	Wet	
1-2625	1-16	2-15-62	3:50 p.m.	Wet	
1-2626	1-36	2-15-62	3:55 p.m.	Wet	

Slide No.	Manhole No.	Date	Time	Weather	Comments
1-2627	1-15	2-15-62	3:55 p.m.	Wet	
1-2628	1-85	2-16-62	2:00 p.m.	Wet	
1-2629	1-64	2-16-62	2:00 p.m.	Wet	
1-2630	1-86	2-16-62	2:05 p.m.	Wet	
1-2631	1-87	2-16-62	2:05 p.m.	Wet	
1-2632	1-88	2-16-62	2:10 p.m.	Wet	
1-2633	1-89	2-16-62	2:10 p.m.	Wet	
1-2634	1-90	2-16-62	2:15 p.m.	Wet	
1-2635	1-95	2-16-62	2:15 p.m.	Wet	
1-2636	1-91	2-16-62	2:20 p.m.	Wet	
1-2637	1-92	2-16-62	2:20 p.m.	Wet	
1-2638	1-99	2-16-62	2:30 p.m.	Wet	
1-2639	1-94	2-16-62	2:35 p.m.	Wet	
1-2640	1-102	2-19-62	10:00 a.m.	Wet	
1-2641	1-103	2-19-62	10:00 a.m.	Wet	
1-2642	1-106	2-19-62	10:00 a.m.	Wet	
1-2643	1-108	2-19-62	10:00 a.m.	Wet	
1-2644	1-109	2-19-62	10:00 a.m.	Wet	
1-2645	1-110	2-19-62	10:15 a.m.	Wet	
1-2646	1-107	2-19-62	10:15 a.m.	Wet	
1-2647	1-137	2-19-62	10:15 a.m.	Wet	
1-2648	1-136	2-19-62	10:15 a.m.	Wet	
1-2649	1-104	2-19-62	10:15 a.m.	Wet	
1-2650	1-111	2-19-62	10:30 a.m.	Wet	
1-2651	1-112	2-19-62	10:30 a.m.	Wet	
1-2652	1-113	2-19-62	10:30 a.m.	Wet	

Slide No.	Manhole No.	Date	Time	Weather	Comments
1-2653	1-114	2-19-62	10:30 a.m.	Wet	
1-2654	1-134	2-19-62	10:45 a.m.	Wet	
1-2655	1-116	2-19-62	10:45 a.m.	Wet	
1-2656	1-115	2-19-62	10:45 a.m.	Wet	
1-2657	1-95	2-19-62	1:30 p.m.	Wet	
1-2658	1-90	2-19-62	1:30 p.m.	Wet	
1-2659	1-91	2-19-62	1:30 p.m.	Wet	
1-2660	1-92	2-19-62	1:30 p.m.	Wet	
1-2661	1-94	2-19-62	1:45 p.m.	Wet	
1-2662	1-93	2-19-62	1:45 p.m.	Wet	
1-2663	1-99	2-19-62	1:45 p.m.	Wet	
1-2664	1-23	2-19-62	1:45 p.m.	Wet	
1-2665	1-24	2-19-62	2:00 p.m.	Wet	
1-2666	1-25	2-19-62	2:00 p.m.	Wet	
1-2667	1-26	2-19-62	2:00 p.m.	Wet	
1-2668	1-28	2-19-62	2:00 p.m.	Wet	
1-2669	1-27	2-19-62	2:00 p.m.	Wet	
1-2670	1-29	2-19-62	2:00 p.m.	Wet	
1-2671	1-32	2-19-62	2:15 p.m.	Wet	
1-2672	1-128	2-19-62	11:00 a.m.	Wet	
1-2673	1-129	2-19-62	11:00 a.m.	Wet	
1-2674	1-131	2-19-62	11:00 a.m.	Wet	
1-2675	1-132	2-19-62	11:00 a.m.	Wet	
1-2676	1-122	2-19-62	11:15 a.m.	Wet	
1-2677	1-123	2-19-62	11:15 a.m.	Wet	
1-2678	1-124	2-19-62	11:15 a.m.	Wet	

Slide No.	Manhole No.	Date	Time	Weather	Comments
1-2679	1-117	2-19-62	11:30 a.m.	Wet	
1-2680	1-118	2-19-62	11:30 a.m.	Wet	
1-2681	1-119	2-19-62	11:30 a.m.	Wet	
1-2682	1-64	2-19-62	1:15 p.m.	Wet	
1-2683	1-85	2-19-62	1:15 p.m.	Wet	
1-2684	1-86	2-19-62	1:15 p.m.	Wet	
1-2685	1-87	2-19-62	1:15 p.m.	Wet	
1-2686	1-88	2-19-62	1:30 p.m.	Wet	
1-2687	1-89	2-19-62	1:30 p.m.	Wet	
1-2688	1-33	2-19-62	2:15 p.m.	Wet	
1-2689	1-68	2-19-62	2:30 p.m.	Wet	
1-2690	1-67	2-19-62	2:30 p.m.	Wet	
1-2691	1-66	2-19-62	2:30 p.m.	Wet	
1-2692	1-65	2-19-62	2:45 p.m.	Wet	
1-2693	1-60A	3-27-62	1:10 p.m.	Dry	
1-2694	1-102	3-27-62	1:50 p.m.	Dry	
1-2695	1-102	3-27-62	2:35 p.m.	Dry	Dye test
1-2696	1-110	3-28-62	2:10 p.m.	Dry	Dye test
1-2697	1-102	3-27-62	4:05 p.m.	Dry	Dye test
1-2698	1-108	3-27-62	2:30 p.m.	Dry	Dye test
1-2699	1-108	3-27-62	4:00 p.m.	Dry	Dye test
1-2700	1-112	3-27-62	2:25 p.m.	Dry	Dye test
1-2701	1-112	3-27-62	2:50 p.m.	Dry	Dye test
1-2702	1-114	3-27-62	2:30 p.m.	Dry	Dye test
1-2703	1-114	3-27-62	2:30 p.m.	Dry	Dye test
1-2704	1-119	3-27-62	3:40 p.m.	Dry	Dye test

Slide No.	Manhole No.	Date	Time	Weather	Comments
1-2709	1-60	12-17-62	10:40 a.m.	Wet	
1-2710	1-60A	12-17-62	10:30 a.m.	Wet	
1-2711	1-61	12-17-62	10:15 a.m.	Wet	
1-2712	1-62	12-17-62	10:13 a.m.	Wet	
1-2713	1-63	12-17-62	10:22 a.m.	Wet	
1-2714	1-69	12-17-62	9:38 a.m.	Wet	
1-2715	1-70	12-17-62	9:36 a.m.	Wet	
1-2716	1-71	12-17-62	9:35 a.m.	Wet	
1-2717	1-72	12-17-62	9:30 a.m.	Wet	
1-2718	1-73	12-17-62	9:40 a.m.	Wet	
1-2719	1-74	12-17-62	9:43 a.m.	Wet	
1-2720	1-75	12-17-62	9:45 a.m.	Wet	
1-2721	1-76	12-17-62	10:10 a.m.	Wet	
1-2722	1-77	12-17-62	10:07 a.m.	Wet	
1-2723	1-78	12-17-62	10:05 a.m.	Wet	
1-2724	1-79	12-17-62	10:03 a.m.	Wet	
1-2725	1-80	12-17-62	10:00 a.m.	Wet	
1-2726	1-83	12-17-62	10:20 a.m.	Wet	
1-2727	1-106	12-17-62	3:02 p.m.	Wet	
1-2728	1-112	12-17-62	3:10 p.m.	Wet	
1-2729	1-113	12-17-62	3:13 p.m.	Wet	
1-2730	1-61	10-17-62			Drop manhole
1-2731	1-109	12-17-62	3:30 p.m.	Wet	
1-2733	1-14	1-30-63	11:25 a.m.	Wet	
1-2747	1-77	1-30-63	2:05 p.m.	Wet	
1-2734	1-16	1-30-63	1:30 p.m.	Wet	

Slide No.	Manhole No.	Date	Time	Weather	Comments
1-2735	1-23	1-30-63	1:30 p.m.	Wet	
1-2736	1-26	1-30-63	1:55 p.m.	Wet	
1-2737	1-36	1-30-63	11:05 a.m.	Wet	
1-2739	1-64	1-30-63	11:25 a.m.	Wet	
1-2738	T-39	1-30-63	1:30 p.m.	Wet	
1-2740	1-62	1-30-63	2:15 p.m.	Wet	
1-2741	1-63	1-30-63	2:05 p.m.	Wet	
1-2742	1-66	1-30-63	1:35 p.m.	Wet	
1-2743	1-69	1-30-63	1:50 p.m.	Wet	
1-2744	1-70	1-31-63	1:50 p.m.	Wet	
1-2745	1-72	1-31-63	1:45 p.m.	Wet	
1-2746	1-73	1-30-63	11:45 a.m.	Wet	
1-2748	1-80	1-30-63	2:15 p.m.	Wet	
1-2749	1-88	1-30-63	1:45 p.m.	Wet	
1-2750	1-90	1-30-63	1:45 p.m.	Wet	
1-2751	1-96	1-30-63	2:00 p.m.	Wet	
1-2752	1-98	1-30-63	2:05 p.m.	Wet	
1-2753	1-102	1-30-63	11:40 a.m.	Wet	
1-2754	1-104	1-30-63	2:35 p.m.	Wet	
1-2755	1-108	1-30-63	2:35 p.m.	Wet	
1-2756	1-109	1-30-63	2:30 p.m.	Wet	
1-2757	1-112	1-30-63	2:45 p.m.	Wet	
1-2758	1-113	1-30-63	2:45 p.m.	Wet	
1-2759	1-115	1-30-63	2:50 p.m.	Wet	
1-2760	1-115	1-31-63	1:40 p.m.	Wet	
1-2761	1-131	1-31-63	1:35 p.m.	Wet	

Slide No.	Manhole No.	Date	Time	Weather	Comments
1-2762	1-134	1-31-63	1:30 p.m.	Wet	
1-2766	1-31	4-17-61		Dry	1 hour after treatment with SC-1
1-2767	1-65	1-31-63	2:15 p.m.	Wet	
1-2768	1-83	1-31-63	2:05 p.m.	Wet	
1-2771	1-60	2-1-63	1:10 p.m.	Wet	
1-2772	1-69	2-1-63	2:15 p.m.	Wet	
1-2773	1-76	2-1-63	2:20 p.m.	Wet	
1-2774	1-127	5-23-63	3:15 p.m.	Wet	
1-2775	1-127	5-23-63	3:15 p.m.	Wet	
1-2776	1-127	5-23-63	3:15 p.m.	Wet	
1-2782	1-136	10-23-64	1:20 p.m.	Dry	
1-2783	1-7A	10-28-64		Wet	
1-2801	1-5	10-23-64	2:20 p.m.	Dry	
1-2802	1-4	10-23-64	2:17 p.m.	Dry	
1-2803	1-4A	10-23-64	2:15 p.m.	Dry	
1-2804	1-60A	10-23-64	2:00 p.m.	Dry	
1-2805	1-103	10-23-64	1:25 p.m.	Dry	
1-2806	1-104	10-23-64	1:15 p.m.	Dry	
1-2807	1-118	10-23-64	1:53 p.m.	Dry	
1-2808	1-125	10-23-64	1:40 p.m.	Dry	
1-2809	1-127	10-23-64	1:30 p.m.	Dry	
1-2810	1-131	10-23-64	1:35 p.m.	Dry	
1-2811	1-145	10-23-64	2:25 p.m.	Dry	

GENERAL

SLIDES

Slide No.	Description	Date
2-154	Lorna Drive 40 feet north of manhole 4. Pipe condition inspection. Joint No. 2	7-16-57
2-155	Lorna Drive 40 feet east of manhole 4. Inspection pipe condition. No. No. 2	7-16-57
2-156	Lorna Drive 10 to 40 feet northeast of manhole 4. Inspection pipe condition. Three joints exposed.	7-17-57
2-157	Lorna Drive 10 to 40 feet northeast of manhole No. 4. Inspection pipe condition. Joint No. 1.	7-17-57
2-158	Lorna Drive 10 to 40 feet northeast of manhole 4. Inspection pipe condition. Joint No. 3.	7-17-57
2-159	Lorna Drive 10 to 40 feet northeast of manhole 4. Pipe condition inspection. Joint No. 3.	7-17-57
2-160	Lorna Drive 10 to 40 feet northeast of manhole 4. Inspection pipe condition. Overall view 7 joints exposed.	7-19-57
2-161	Lorna Drive 10 to 40 feet northeast of manhole 4. Inspection pipe condition. Seven joints exposed.	7-19-57.
2-162	Lorna Drive 10 to 40 feet northeast of manhole 4. Pipe condition inspection. Joint No. 4.	7-19-57
2-163	Lorna Drive 10 to 40 feet northeast of manhole 4. Pipe condition inspection. Joing No. 4.	7-19-57
2-164	Lorna Drive 10 to 40 feet northeast of manhole 4. Inspection pipe condition. Joint No. 5.	7-19-57
2-165	Lorna Drive 10 to 40 feet northeast of manhole 4. Pipe condition inspection. Joint No. 6.	7-19-57
2-166	Lorna Drive 10 to 40 feet northeast of manhole 4. Pipe condition inspection. Joint No. 7.	7-19-57
2-167	Lorna Drive 10 to 40 feet northeast of manhole 4. Pipe condition inspection. Joint No. 8.	7-22-57
2-168	Lorna Drive 10 to 40 feet northeast of manhole 4. Pipe condition inspection. Joint No. 8.	7-22-57
2-169	Lorna Drive 10 to 40 feet northeast of manhole 4. Pipe condition inspection. Joint No. 2.	7-22-57

Slide No.	Description	Date
2-170	6 inch pipe from Lorna Drive	7-23-57
2-171	6 inch pipe from Lorna Drive	7-23-57
2-172	Lorna Drive. Water test on pipe from L.I.D. 3	7-23-57
2-173	Lorna Drive. Water test on pipe from L.I.D. 3	7-23-57
2-174	Lorna Drive. Water test on pipe from L.I.D. 3.	7-23-57
2-175	Lorna Drive. Line replacement	7-25-57
2-176	Lorna Drive pipe test.	7-26-57
2-177	Lorna Drive	7-26-57
2-178	Lorna Drive	7-26-57
2-179	Lorna Drive	7-26-57
2-257	Solano Drive L.I.D. No. 2, Station 2+40 ± west from manhole 2-41. Water table in ditch.	10-16-57
2-258	Solano Drive L.I.D. No. 2. Vitrified clay pipe almost submerged.	10-16-57
2-259	Solano Drive L.I.D. No. 2.	10-18-57
2-260	Solano Drive L.I.D. No. 2 mortar joint exposed.	10-18-57
2-261	Dye test in Bay Alley north of Solano.	10-21-57
2-262	Dye test in Bay Alley north of Solano.	10-21-57
2-263	Dye test in Bay Alley north of Solano.	10-21-57
2-266	Dye test Solano L.I.D. No. 2 at Station 2+32 west from Manhole 241	10-21-57
2-267	Solano L.I.D. No. 2 at Station 2+32 west from manhole 241	10-21-57
2-270	Solano L.I.D. No. 2 at Station 2+52 west from manhole 241	10-21-57
2-271	Solano L.I.D. No. 2. Method of jointing.	10-22-57
2-272	Solano L.I.D. No. 2 invert in joint No. 4	10-22-57

Slide No.	Description	Date
2-273	Solano L.I.D. No. 2 joint No. 4	10-22-57
2-274	Dye test in trench Arroyo and Vallejo	10-28-57
2-275	Dye test Arroyo and Vallejo, 3rd joint downstream	10-28-57
2-276	Dye test at Arroyo Vallejo, 4th joint downstream.	10-28-57
2-277	Dye test at Manhole 192 first joint downstream.	10-30-57
2-278	Manhole 1-85 Arroyo second and third joints downstream.	10-30-57
2-279	Dye test Arroyo and Vallejo second joint downstream.	10-30-57
2-280	Dye test 1-85 Arroyo, 3rd, 4th, 5th and 6th joints downstream.	10-30-57
2-281	Manhole 1-96 Las Lomas first and second joint upstream.	10-30-57
2-282	Manhole 1-96 Las Lomas 2nd, 3rd, 4th and 5th joints upstream.	10-30-57
2-283	Manhole 1-96 Las Lomas third joint upstream.	10-30-57
2-284	Manhole 1-96 Las Lomas fifth joint upstream.	10-30-57
2-285	Dye test Maldanado and Second, first joint downstream. Keep No. 285 for the report.	10-30-57
2-286	Dye test Maldanado and Second, fourth joint downstream.	10-30-57
2-287	Dye test Maldanado and Second, third joint downstream.	10-30-57
2-288	Manhole 1-17 Thomson Avenue joint No. 1 downstream.	10-30-57
2-289	Manhole 1-17 Thomson Avenue, first and second joint downstream.	10-30-57
2-290	M.H. 1-17 Thomson Avenue, 2nd, 3rd and 4th joints downstream.	10-30-57
2-291	M.H. 1-17 Thomson Avenue 4th and 5th joints downstream.	10-30-57
2-292	M.H. 1-17 Thomson Avenue 6th and 7th joints downstream.	10-30-57
2-293	Marty Drive L.I.D. No. 3 joints 1 and 2 91 feet ± north of M.H. 3-3	10-31-57

Slide No.	Description	Date
2-294	Marty Drive joints 3 and 4 north of M.H. 3-3.	10-31-57
2-295	Marty Drive joints, 4, 5, and 6 north of M.H. 3-3	10-31-57
2-296	Marty Drive joints 6, 7 and 8 north of M.H. 3-3	10-31-57
2-297	Marty Drive joint 10 north of M.H. 3-3	10-31-57
2-298	Marty Drive joint 11 north of M.H. 3-3.	10-31-57
2-299	Cecelia Drive joint number one 8 feet west of M.H. 3-2. L.I.D. No. 3.	10-31-57
2-300	Cecelia Drive joint number two early during test west of M.H. 3-2.	10-31-57
2-301	Cecelia Drive west of M.H. 3-2 joint two.	10-31-57
2-302	Cecelia Drive joint 3 west of M.H. 3-2	10-31-57
2-303	Cecelia Drive joint 4 west of M.H. 3-2	10-31-57
2-304	Joint No. 5 Cecelia Drive west of M.H. 3-2.	10-31-57
2-305	Cecelia Drive joint 6 west of M.H. 3-2	10-31-57
2-306	Cecelia Drive joint 7 west of M.H. 3-2	10-31-57
2-307	Laurel and Hickory, El Verano, excavation for exfiltration test.	10-31-57
2-308	Laurel and Hickory, El Verano, excavation for exfiltration test.	10-31-57
2-309	Disregard Slide No. 309	10-31-57
2-311	Water test Marty Drive, 111 feet north of M.H. 3	11-29-57
2-312	Water test Cecelia Drive, 11 feet west of M.H. 2	11-29-57
2-313	Water test Arroyo and Madera, 40 feet east of M.H. 1-85	11-29-57
2-314	Water test Thomson Street, 71 feet east of M.H. 17	11-29-57
2-315	Arroyo and Verde Vista, section of pipe from 50 feet east of 1-92.	11-29-57
2-316	Water test Lorna Drive	11-29-57

Slide No.	Description	Date
2-317	Water test Solano.	11-29-57
2-318	Water test Alley off Bay	11-29-57
2-319	Water test 111 feet north of M.H. 3 Marty Drive	11-29-57
2-349	Watmaugh Road flume manhole	12-5-57
2-350	Watmaugh Road flume manhole.	12-5-57
2-351	Watmaugh Road flume manhole.	12-5-57
2-352	Watmaugh Road flume manhole.	12-5-57
2-381	Watmaugh Road meter installation	1-8-58
2-382	House service connection south of M.H. T-72	1-14-58
2-383	House service connection south of M.H. T-72	1-14-58
2-384	House service connection south of M.H. T-72	1-14-58
2-385	House service connection south of M.H. T-72	1-14-58
2-386	Arroyo and Madera cut away sections showing internal SS-1 application	1-15-58
2-387	Arroyo and Madera cut away sections showing internal SS-1 application	1-15-58
2-388	Arroyo and Madera cut away sections showing internal SS-1 application	1-15-58
2-389	Arroyo and Madera cut away sections showing internal SS-1 application.	1-15-58
2-390	Arroyo and Madera cut away sections showing internal SS-1 application.	1-15-58
2-391	Arroyo and Madera cut away sections showing internal SS-1 application.	1-15-58
2-392	Arroyo and Madera cut away sections showing internal SS-1 application.	1-15-58
2-393	Arroyo and Madera cut away sections showing internal SS-1 application.	1-15-58
2-406	Watmaugh Road meter station	1-24-58

Slide No.	Description	Date
2-407	Watmaugh Road meter station.	2-4-58
2-414	Splude Road overflow	1-24-58
2-416	Water level pipe on Cecelia Drive.	3-10-58
2-417	Water level pipe on Cecelia Drive.	3-10-58
2-418	Water level pipe on Cecelia Drive.	3-10-58
2-419	Water level pipe on Cecelia Drive.	3-10-58
2-420	Water level pipe on Cecelia Drive.	3-10-58
2-421	Water level pipe on Cecelia Drive.	3-10-58
2-422	Water level pipe on Cecelia Drive.	3-10-58
2-423	Water level pipe on Cecelia Drive.	3-10-58
2-424	Water level pipe on Cecelia Drive.	3-10-58
2-425	Water level pipe on Cecelia Drive.	3-10-58
2-430	Placing dye in a well point.	3-18-58
2-431	Filling well point.	3-18-58
2-510	Davidson Street joint of pipe.	5-26-58
2-511	Davidson Street typical joints	3-18-58
2-512	Davidson Street typical joints	3-18-58
2-513	Davidson Street prior to water test.	5-27-58
2-514	Davidson Street water test.	5-27-58
2-515	M.H. No. 2-16 prior to hot seal test.	6-19-58
2-517	Davidson Street hot seal test start of test.	6-19-58
2-518	Davidson Street hot seal test. Hot oil tank.	6-19-58
2-519	Davidson Street hot seal test. Disassembly of hookup.	6-19-58

Slide No.	Description	Date
2-520	Davidson Street hot seal test. Hot oil tank hooked up to pipe No. 2.	6-19-58
2-521	Davidson Street hot seal test. Hot oil tank hooked to pipe No. 3.	6-19-58
2-522	Davidson hot asphalt test. Hot asphalt entering line.	6-19-58
2-523	Davidson Street hot asphalt test. Hot asphalt entering line.	6-19-58
2-524	Davidson Street hot seal test. Hot oil tank hooked to pipe No. 6.	6-19-58
2-525	Davidson Street hot seal test. Hot oil tank hooked to pipe No. 7.	6-19-58
2-526	Davidson Street hot seal test. Close up of applicators No. 7, 8 and 9.	6-19-58
2-527	Davidson Street hot seal test. Overall spacing of nine applicators. On Railroad Avenue.	6-19-58
2-528	Davidson Street hot seal test, pressure cracks in pavement.	6-19-58
2-529	Davidson Street hot seal test. Water test of line.	6-20-58
2-530	Davidson Street hot seal test. Water test of line. Dye added.	6-20-58
2-531	Davidson Street hot asphalt test looking east from 0+40 to 0+20 after application.	6-23-58
2-532	Davidson Street hot asphalt test, Book 5G-page 51 looking west from 0+45 to 0+55.	6-23-58
2-533	Davidson Street hot asphalt experiment book 5G-page 51 looking west from 0+65.	6-23-58
2-534	Davidson Street hot asphalt experiment.	6-23-58
2-535	Davidson Street after application of hot asphalt 0+90 to 1+05. Cracks due to application.	6-23-58
2-536	Davidson Street after application of hot asphalt 1+05 to 1+00 cracks due to application.	6-23-58

Slide No.	Description	Date
2-537	Davidson Street hot asphalt experiment book 5G-page 51	6-23-58
2-538	Davidson Street M.H. 13	6-24-58
2-539	Davidson Street sealing test exposing line	6-24-58
2-540	Davidson Street workmen exposing joint.	6-24-58
2-541	Davidson Street workmen uncovering line.	6-24-58
2-542	Davidson Street excavation	6-24-58
2-543	Davidson Street excavation looking west from 0+40.	6-24-58
2-544	Davidson Street hot asphalt experiment Book 5G-page 51	6-24-58
2-545	Davidson Street	6-24-58
2-546	Davidson Street	6-24-58
2-547	Davidson Street	6-24-58
2-548	Davidson Street	6-24-58
2-549	Davidson Street. This slide shows a ring of asphalt in the bell showing that the asphalt did penetrate past the fillet of mortar which constituted the joint.	6-24-58
2-550	Davidson Street sealing test. Joint 4 feet downstream from M.H. 16	6-24-58
2-551	Davidson Street sealing test joint 4 feet down from M.H. 16.	6-24-58
2-552	Davidson Street sealing test joint 4 feet down from M.H. 16	6-24-58
2-553	Davidson Street sealing test joint 4 feet downstream from m.H. 16	6-24-58
2-554	Davidson Street sealing test joint 4 feet downstream M.H. 16	6-24-58
2-555	Davidson Street sealing test joint 4 feet downstream from M.H. 16	6-24-58
2-556	Davidson Street hot asphalt experiment Book 5G page 51	6-24-58
2-557	Davidson Street pipe taken from 0+92.	6-24-58

Slide No.	Description	Date
2-558	Davidson Street 0+92	6-24-58
2-559	Davidson Street 0+95	6-24-58
2-560	Davidson Street asphalt removed from pipe at 0+95.	6-24-58
2-561	Davidson Street sealing test 0+99.	6-24-58
2-562	Davidson Street 0+99	6-24-58
2-563	Davidson Street 0+99.5	6-24-58
2-564	Davidson Street 0+99.5	6-24-58
2-565	Davidson Street looking west from 1+30 excavation.	6-24-58
2-566	Davidson Street 1+35.	6-24-58
2-567	Davidson Street excavation from 2+20 to 2+29.1 looking west.	6-24-58
2-568	Davidson Street hot asphalt experiment looking north at pipe No. 2	6-24-58
2-569	Davidson Street hot asphalt experiment Book 5-G page 51. Near pipe No. 3 note vein of asphalt.	6-24-58
2-570	Davidson Street hot asphalt experiment Book 5-G page 51. Look west. Workmen at pipe No. 3	6-24-58
2-571	Davidson Street hot asphalt experiment Book 5-G page 51, looking west at pipe No. 4	6-24-58
2-572	Davidson Street hot asphalt experiment Book 5-G page 51, near pipe No. 8.	6-24-58
2-573	Davidson Street hot asphalt experiment Book 5-G page 51, vein of asphalt near pipe No. 8.	6-24-58
2-574	Davidson Street hot asphalt experiment Book 5-G page 51, note vein of asphalt near pipe No. 8.	6-24-58
2-575	Davidson Street hot asphalt experiment Book 5-G page 51, vein of asphalt near pipe No. 8	6-24-58
2-576	Davidson Street hot asphalt experiment Book 5-G page 51 looking west at Station 0+47.5	6-24-58

Slide No.	Description	Date
2-577	Davidson Street hot asphalt experiment Book 5-G page 51. Joint near pipe No. 8 in left.	6-24-58
2-578	Davidson Street sealing test joint 8 feet downstream from M.H. 16	6-24-58
2-579	Davidson Street hot asphalt experiment Book 5-G page 51 Joint near pipe No.8 to the right.	6-24-58
2-580	Davidson Street hot asphalt experiment Book 5-G page 51 near pipe No. 8	6-24-58
2-581	Davidson Street hot asphalt experiment Book 5-G page 51.	6-24-58
2-582	Davidson Street	6-28-58
2-583	Davidson Street	6-26-58
2-584	Davidson Street section of pipe outside trench.	6-26-58
2-585	Davidson Street section of pipe outside trench.	6-26-58
2-586	Davidson Street. Asphalt covering inside of bell and part spigot. Very little bond with mortar.	6-28-58
2-587	Davidson Street asphalt on both bell and spigot.	6-26-58
2-588	Davidson Street hot asphalt sealing test.	6-26-58
2-589	Fifth Street water test before asphalt seal test.	6-27-58
2-590	Fifth Street test. Water test of line.	6-27-58
2-591	Fifth Street water test before asphalt seal test.	6-27-58
2-592	Fifth Street test. Water test of line.	6-27-58
2-593	Fifth Street. Punching holes for applying asphalt to trench.	7-2-58
2-594	Fifth Street. Punching holes for applying asphalt to soil.	7-58
2-595	Fifth Street. Punching holes for applying asphalt in trench.	7-58
2-596	Fifth Street. Rig used for applying asphalt to trench.	7-9-58
2-597	Fifth Street. Rig used for applying asphalt to trench.	7-9-58

Slide No.	Description	Date
2-598	Fifth Street. Rig used for applying asphalt to trench.	7-9-58
2-599	Fifth Street. Rig used for applying asphalt to trench.	7-9-58
2-600	Fifth Street. Rig used for applying asphalt to trench.	7-9-58
2-601	Fifth Street. Applicators staggered down the trench.	7-9-58
2-602	Fifth Street. Asphalt in sewer pipe during trial.	7-9-58
2-603	Fifth Street. Asphalt in line due to test.	7-9-58
2-604	Fifth Street test. Manhole 28 during water test. After treating with RS-1	7-10-58
2-605	Fifth Street test. Manhole 28 during water test after treating with RS-1.	7-10-58
2-615	Fifth Street 0+60	7-58
2-616	Fifth Street 0+60.	7-58
2-617	Fifth Street 0+60	7-58
2-618	Fifth Street excavation.	7-58
2-619	Fifth Street excavation voids in backfill.	7-25-58
2-620	Fifth Street excavation pocket of dyed water.	7-25-58
2-621	Fifth Street test. Excavation on Fifth Street. Break in pipe	7-25-58
2-622	Fifth Street test. Excavation on Fifth Street.	7-25-58
2-623	Fifth Street test. Break in 6 inch vitrified clay pipe.	7-25-58
2-624	Fifth Street test. Excavation on Fifth Street.	7-25-58
2-625	Fifth Street test. Break in 6 inch vitrified caly pipe near M.H. 28.	7-25-58
2-626	Fifth Street test. Looking northeast at M.H. 28	7-25-58
2-627	Fifth Street test. Excavation looking south toward M.H. 28.	7-25-58

Slide No.	Description	Date
2-628	Fifth Street test. Excavation looking south toward M.H. 28.	7-25-58
2-629	Fifth Street test. North of M.H. 28 on Fifth Street.	7-25-58
2-630	Fifth Street test looking south to M.H. 28.	7-25-58
2-631	Fifth Street test north of M.H. 28.	7-25-58
2-632	Fifth Street test looking northeast from M.H. 28	7-25-58
2-633	Fifth Street test north east corner of M.H. 28.	7-25-58
2-634	Fifth Street test joint north of M.H. 28.	7-25-58
2-635	Fifth Street test joint north of M.H. 28	7-25-58
2-636	Fifth Street test asphalt level line on corrugated metal pipe at 0+10	7-25-58
2-637	Fifth Street test. Backfill on Fifth Street over pipe at about 0+9.	7-25-58
2-638	Fifth Street test. Line on Baines Avenue east of M.H.28	7-25-58
2-639	Fifth Street test. Cavities in backfill at M.H. 28.	7-25-58
2-640	Fifth Street test. Break in 6 inch vitrified clay just north of M.H. 28.	7-25-58
2-641	Fifth Street test. Break on line at M.H. 28	7-25-58
2-642	Fifth Street. Cavities in backfill at M.H. 28.	7-25-58
2-643	Fifth Street test. Excavation at 0+60	7-29-58
2-644	Fifth Street test. Excavation at 0+60. Injector had hit pipe bell.	7-29-58
2-645	Fifth Street test. Pocket of dyed water at 0+70.	7-29-58
2-646	Fifth Street test. Cavity in backfill at 0+70.	7-29-58
2-647	Fifth Street test. Vitrified clay pipe.	7-29-58
2-648	Fifth Street test. Backfill at 0+70.	7-29-58
2-649	Fifth Street test. Excavation at 0+60.	7-29-58

Slide No.	Description	Date
2-650	Fifth Street test. Cavity in backfill at 0+70.	7-29-58
2-651	Fifth Street test. Looking south at 0+65.	7-29-58
2-652	Fifth Street test. Excavation from 0+60 to 0+70	7-29-58
2-653	Fifth Street test. Excavation at 0+60.	7-29-58
2-654	Fifth Street test. Cavity in backfill at 0+70.	
2-655	RS-1 test set up at corporation yard.	8-6-58
2-656	RS-1 coming to surface around applicator pipe at corporation yard.	8-58
2-657	RS-1 pipe sealing test at corporation yard.	8-58
2-658	RS-1 pipe sealing test at corporation yard.	8-58
2-659	RS-1 pipe sealing test at corporation yard.	8-6-58
2-660	RS-1 pipe sealing test at corporation yard.	8-6-58
2-661	RS-1 pipe sealing test at corporation yard.	8-6-58
2-662	RS-1 pipe sealing test at corporation yard.	8-6-58
2-663	RS-1 pipe sealing test at corporation yard.	8-6-58
2-664	RS-1 pipe sealing test at 0+26 at corporation yard.	8-7-58
2-665	RS-1 pipe sealing test at corporation yard at 0+26.	8-7-58
2-666	SC-1 test at corporation yard at Station 0+00	8-13-58
2-667	SC-1 pipe sealing test at corporation yard 0+05	8-13-58
2-668	SC-1 pipe sealing test at corporation yard 0+05	8-13-58
2-669	SC-1 test at corporation yard 0+05.	8-13-58
2-670	SC-1 test at corporation yard 0+05.	8-13-58
2-671	SC-1 test at corporation yard 0+05.	8-13-58
2-672	SC-1 test at corporation yard 0+05	8-13-58
2-673	SC-1 test at corporation yard 0+05	8-13-58
2-674	SC-1 test at corporation yard 0+05	8-13-58

Slide No.	Description	Date
2-675	SC-1 test at corporation yard 0+05.	8-13-58.
2-676	SC-1 test at corporation yard 0+05.	8-13-58.
2-677	SC-1 test at corporation yard 0+05.	8-13-58
2-678	SC-1 test at corporation yard 0+05	8-13-58
2-679	SC-1 test at corporation yard 0+05	8-13-58
2-680	SC-1 test at corporation yard 0+05.	8-13-58
2-681	SC-1 test at corporation yard 0+05	8-13-58
2-682	SC-1 test at corporation yard 0+05.	8-13-58
2-683	SC-1 test at corporation yard 0+05.	8-13-58
2-684	SC-1 test at corporation yard 0+05.	8-13-58
2-685	SC-1 test at corporation yard 0+05.	8-13-58
2-688	Test at corporation yard. Treatment by SC-1 only	8-20-58
2-689	Test at corporation yard. Treatment by SC-1 only.	8-20-58
2-690	Test at corporation yard. Treatment by SC-1 only.	8-20-58
2-692	Test at corporation yard. Treatment by SC-1 only.	8-20-58
2-693	Test at corporation yard. Treatment by SC-1 only.	8-20-58
2-694	Test at corporation yard. Treatment by SC-1 only.	8-20-58
2-695	Test at corporation yard. Treatment by SC-1 only.	8-20-58
2-696	Test at corporation yard. RS-1 preceded by SC-1.	10-2-58
2-697	Test at corporation yard. RS-1 preceded by SC-1.	10-2-58
2-698	Test at corporation yard. RS-1 preceded by SC-1.	10-2-58
2-699	Test at corporation yard. RS-1 preceded by SC-1.	10-2-58
2-700	Test at corporation yard. RS-1 preceded by SC-1.	10-2-58
2-701	Test at corporation excavated material from trench. SC-1 followed by RS-1.	10-2-58

Slide No.	Description	Date
2-702	Test at corporation yard. SC-1 followed by RS-1. Water test in hole at 0.0 minutes.	10-2-58
2-704	Test at corporation yard. SC-1 followed by RS-1.	10-2-58
2-703	Test at corporation yard. SC-1 followed by RS-1. Water test in hole at 0+7 minutes.	10-2-58
2-705	Test at corporation yard. SC-1 followed by RS-1.	10-2-58
2-706	Test at corporation yard. SC-1 followed by RS-1.	10-2-58
2-707	Test at corporation yard. SC-1 followed by RS-1.	10-2-58
2-708	Test at corporation yard. SC-1 followed by RS-1. Water test in hole 4:30 p.m.	10-2-58
2-709	Test at corporation yard. SC-1 followed by RS-1.	10-3-58
2-710	Test at corporation yard. SC-1 followed by RS-1. looking north.	10-10-58
2-711	Test at corporation yard. SC-1 followed by RS-1 looking north.	10-10-58
2-712	Test at corporation yard. SC-1 followed by RS-1.	10-10-58
2-713	Test at corporation yard. Excavation of SC-1 followed by RS-1.	10-10-58
2-714	Test at corporation yard. Excavation. SC-1 followed by RS-1.	10-10-58
2-715	Test at corporation yard. SC-1 followed by RS-1.	10-10-58
2-716	Test at corporation yard overall view. SC-1 followed by RS-1.	10-10-58
2-721	Test at corporation yard. SC-1 followed by RS-1 Water test in hole. 0+15 minutes.	10-2-58
2-722	Test at corporation yard. SC-1 followed by RS-1. Filling hole with water for water test.	10-2-58
2-723	Test at corporation yard. SC-1 followed by RS-1.	10-2-58
2-724	Test at corporation yard. RS-1 preceded by SC-1.	10-2-58

Slide No.	Description	Date
2-725	Test at corporation yard. SC-1 followed by RS-1.	10-10-58
2-726	Pipe sealing test on Arroyo Road. Test set up at M.H. 99	10-16-58
2-727	Pipe sealing test on Arroyo Road. M.H. 92 showing flow of SC-1.	10-24-58
2-728	Pipe sealing test at Arroyo Road. M.H. 99 before starting test.	10-16-58
2-729	Pipe sealing test at Arroyo Road. Hole made with posthole digger for applicator No. 1A. SC-1 poured in bottom.	10-22-58
2-730	Pipe seal test at Arroyo Road. Placing applicator in No. 1A hole.	10-22-58
2-731	Pipe seal test on Arroyo Road. Photographic view downstream via mirrors.	10-24-58
2-732	Pipe seal test on Arroyo Road. SC-1 in 50 gallon barrels at M.H. 99.	10-18-58
2-733	M.H. 1-91. Asphalt seeped through manhole base.	11-5-58
2-734	M.H. 1-92. Removing RS-1 from inside sewer.	11-5-58
2-735	M.H. 1-91. Asphalt seeped through manhole base.	11-5-58
2-758	M.H. 1-91. Interior shot south of Verde Vista.	12-3-58
2-759	Manhole 1-92. Upstream toward Verde Vista.	12-3-58
2-760	M.H. 1-91 upstream M.H. 1-99 upstream.	12-3-58
2-761	M.H. 1-91 downstream. M.H. 1-99 downstream.	12-3-58
2-762	M.H. 1-99 downstream. M.H. 1-92 upstream.	12-15-58 12-3-58
2-763	M.H. 1-92 looking upstream toward 1-99.	12-3-58
2-769	Watmaugh meter	12-4-58
2-771	Watmaugh meter	12-4-58
2-772	Watmaugh meter	12-4-58

Slide No.	Description	Date
2-773	Rain gauge installed at El Verano corporation yard.	12-58
2-774	Closeup of the rain gauge at El Verano yard.	12-58
2-775	Closeup of the recorder portion of the rain gauge.	12-58
2-776	View of the recorder portion of the rain gauge	12-58
2-777	Manhole 1-92 upstream. Interior shots.	12-15-58
2-778	M.H. 1-99 downstream.	12-15-58
2-807	Splude Road overflow. Wet weather condition	1-9-59
2-808	Splude Road overflow. Wet weather condition.	1-9-59
2-810	Splude Road overflow. Wet weather condition.	1-9-59
2-809	Splude Road overflow. Wet weather condition.	1-9-59
2-811	M.H. 1-99, internal shot of the line looking upstream.	1-13-59
2-812	M.H. 1-99, downstream.	1-13-59
2-857	M.H. 1-99, downstream	3-16-59
2-858	M.H. 1-99,	3-16-59
2-859	Arroyo Road, M.H. 1-99	3-16-59
2-860	Arroyo Road, M.H. 1-99	3-16-59
2-861	Arroyo Road, M.H. 1-99, 18 inches deep	3-16-59
2-862	Arroyo Road M.H. 1-99, 30 inches deep.	3-16-59
2-863	Arroyo Road, M.H. 1-99, 36 inches deep.	3-16-59
2-864	Arroyo Road, M.H. 1-99, 39 inches deep.	3-16-59
2-865	Arroyo Road, M.H. 1-99, oil cavity	3-16-59
2-866	Arroyo Road 6 feet west of M.H. 1-99	3-16-59
2-867	Arroyo Road 6 feet west of M.H. 1-99.	3-16-59
2-870	Arroyo Road 7-14 feet west of M.H. 1-99. Bedding of oil.	3-16-59
2-871	Arroyo Road. Concentrated oil pocket, 9 feet west of M.H. 1-99. 3-16-59.	

Slide No.	Description	Date
2-872	Arroyo Road 9 feet west of M.H. 1-99	3-16-59
2-873	Arroyo Road 1-99, 12 to 14 feet west of M.H. 1-99	3-16-59
2-874	Arroyo Road 12-14 feet west of M.H. 1-99.	3-16-59
2-875	Arroyo Road 12-14 feet west of M.H. 1-99.	3-16-59
2-876	Arroyo Road 12-14 feet west of M.H. 1-99	3-16-59
2-877	Arroyo Road 18 inches west of M.H. 1-99.	3-16-59
2-878	Arroyo Road 18 inches west of M.H. 1-99.	3-16-59
2-879	Arroyo Road 18 inches west of M.H. 1-99.	3-16-59
2-880	Arroyo Road. Pipe bell 15 feet west of M.H. 1-99.	3-17-59
2-881	Arroyo Road. Pipe bell 15 feet west of M.H. 1-99.	3-17-59.
2-882	Arroyo Road. Pipe bell 15 feet west of M.H. 1-99.	3-17-59
2-883	Arroyo Road west of M.H. 1-99. Downstream wyes.	3-17-59
2-884	Arroyo Road west of M.H. 1-99, asphalt on wyes.	3-17-59
2-885	Arroyo Road M.H. 1-99, asphalt on wyes.	3-17-59
2-886	Arroyo Road M.H. 1-99, wyes.	3-17-59
2-887	Arroyo Road west of M.H. 1-99, wyes.	3-17-59
2-888	Arroyo Road west of M.H. 1-99, water penetration as of 10:20 a.m.	3-17-59
2-889	Arroyo Road west of M.H. 1-99, water penetration at 10:40 a.m.	3-17-59
2-890	Arroyo Road west of M.H. 1-99. Water penetration 1:05 p.m.	3-17-59
2-891	Arroyo Road 26 feet west of M.H. 1-99.	3-18-59
2-892	Arroyo Road 29 feet west of M.H. 1-99	3-18-59
2-893	Arroyo Road 32 feet west of M.H. 1-99. Closeup of pipe before removal.	3-18-59

Slide No.	Description	Date
2-894	Arroyo Road, 36 feet west of M.H. 1-99	3-18-59
2-895	Arroyo Road, 67 feet west of M.H. 1-99	3-18-59
2-896	Arroyo Road, 67 feet west of M.H. 1-99	3-18-59
2-897	Arroyo Road, 32 feet west of M.H. 1-99. Bed of asphalt.	3-20-58
2-898	Arroyo Road, 32 feet west of M.H. 1-99. East end of excavation.	3-20-58
2-899	Arroyo Road, 32 feet west of M.H. 1-99. End section of pipe and bed of asphalt.	3-20-59
2-900	Arroyo Road, 32 feet west of M.H. 1-99. End section of pipe and bed of asphalt.	3-20-59
2-901	Arroyo Road, 32 feet west of M.H. 1-99. Pipe removed showing bed of asphalt.	3-20-59
2-902	Arroyo Road. Pipe removed at 32 feet ± west of M.H. 1-99.	3-20-59
2-904	Arroyo Road. Section of joining material.	3-20-59
2-1018	Arroyo Road. Water percolation test west of M.H. 99. Time 2:44 p.m.	5-5-59
2-1019	Arroyo Road water percolation test west of M.H. 99. Time 3:35 p.m.	5-5-59
2-1020	Arroyo Road water percolation test west of M.H. 99. Time 3:01 p.m.	5-5-59
2-1021	Arroyo Road water test west of M.H. 99. Time 9:30 a.m.	5-6-59
2-1022	Arroyo Road west of M.H. 99. Excavation	5-5-59
2-1023	Arroyo Road. Lot assessment #10-98. House service, sealing experiment.	5-5-59
2-1024	Arroyo Road. Water percolation test on wye to the assessment #10-98. Time 2:54 p.m.	5-5-59
2-1025	Arroyo Road. Water percolation test on wye to the assessment #10-98.	5-5-59
2-1026	Arroyo Road. Water percolation test on wye to the assessment. #10-98.	5-5-59

Slide No.	Description	Date
2-1027	Arroyo Road. Water percolation test on wye to the assessment #10-98.	5-5-59
2-1028	Arroyo Road. West of manhole 99. Asphalt in gravel below pipe.	5-6-59
2-1029	Arroyo Road. Wye on main line to lot assessment. #10-98	5-6-59
2-1047	Flushing inlet Sonoma Valley L.I.D. #2 between Oak and Walnut.	7-20-59.
2-1262	Asphalt bucket test.	3-15-60.
2-1263	Asphalt bucket test.	3-15-60
2-1264	Asphalt bucket test.	3-15-60
2-1265	McSweeney lateral, Arroyo Road near manhole 1-99.	4-22-60
2-1266	McSweeney lateral, Arroyo Road near manhole 1-99.	4-22-60
2-1267	McSweeney lateral, Arroyo Road near manhole 1-99	4-22-60
2-1268	McSweeney lateral, Arroyo Road near manhole 1-99	4-22-60
2-1269	McSweeney lateral, Arroyo Road near manhole 1-99.	4-22-60
2-1270	Repairs to the McSweeney lateral.	4-28-60
2-1271	Repairs to the McSweeney lateral.	4-28-60
2-1272	Repairs to the McSweeney lateral.	4-28-60
2-1273	Repairs to the McSweeney lateral.	4-28-60
2-1274	Repairs to the McSweeney lateral.	4-28-60
2-1275	Repairs to the McSweeney lateral.	4-28-60
2-1288	Las Lomas. Asphalt in excavation downstream from M.H. 1-96.	4-13-60
2-1289	Las Lomas. Asphalt in excavation downstream from M.H. 1-96.	4-13-60

Slide No.	Description	Date
2-1290	Las Lomas. Asphalt in excavation downstream from M.H. 1-96.	4-13-60
2-1291	Las Lomas. Asphalt in excavation downstream from M.H. 1-96.	4-13-60
2-1292	Las Lomas. Asphalt in excavation downstream from M.H. 1-96.	4-13-60
2-1293	Las Lomas. Asphalt in excavation downstream from M.H. 1-96.	4-13-60
2-1298	Las Lomas. Upstream from M.H. 1-96 excavation shows results of sealant process.	7-5-60
2-1299	Las Lomas. Rock coated with sealant upstream from M.H. 1-96.	7-5-60
2-1300	Las Lomas. Excavation upstream from M.H. 1-96. 3/4 foot above the sewer, showing sealant.	7-5-60
2-1301	Las Lomas. Upstream from M.H. 1-96. 3/4 foot above the sewer, south bank removed.	7-5-60
2-1302	Las Lomas. Upstream from m.h. 1-96. Excavation exposing sewer line and sealant.	7-5-60
2-1303	Las Lomas. Upstream from M.H. 1-96 excavation exposing sewer line and sealant.	7-5-60
2-1304	Las Lomas. 12 feet upstream from manhole 1-96. Excavation exposing bell and sealant.	7-5-60
2-1305	Las Lomas. 12 feet upstream from M.H. 1-96. Excavation exposing bell and sealant.	7-5-60
2-1306	Las Lomas. 12 feet upstream from M.H. 1-96. Excavation closeup exposing bell and sealant.	7-5-60
2-1307	Las Lomas. 12 feet upstream from M.H. 1-96. Excavation closeup exposing bell and sealant.	7-5-60
2-1308	Las Lomas. 12 feet upstream from M.H. 1-96. Excavation exposing sewer line and sealant.	7-5-60
2-1309	Las Lomas. 12 feet upstream from M.H. 1-96. Excavation exposing sewer line and sealant.	7-5-60

Slide No.	Description	Date
2-1310	Las Lomas. Asphalt sealing north of M.H. 1-96.	7-5-60
2-1311	Las Lomas. Asphalt sealing north of M.H. 1-96.	7-5-60
2-1312	Las Lomas. Asphalt sealing 6 feet north of M.H. 1-96.	7-5-60
2-1313	Las Lomas. Asphalt sealing 6 feet north of M.H. 1-96.	7-5-60
2-1314	Las Lomas. Asphalt sealing 6 feet north of M.H. 1-96.	7-5-60
2-1315	Las Lomas. Asphalt sealing 6 feet north of M.H. 1-96.	7-5-60
2-1316	Las Lomas. Asphalt sealing 6 feet north of M.H. 1-96.	7-5-60
2-1317	Las Lomas. Asphalt sealing 6 feet north of M.H. 1-96.	7-5-60
2-1318	Las Lomas. Asphalt sealing 6 feet north of M.H. 1-96.	7-5-60
2-1319	Las Lomas. Asphalt sealing 6 feet north of M.H. 1-96.	7-5-60
2-1320	Las Lomas. Asphalt sealing 6 feet north of M.H. 1-96.	7-5-60
2-1321	Las Lomas. Asphalt sealing 6 feet north of M.H. 1-96.	7-5-60
2-1322	Las Lomas. Asphalt sealing 12 feet north of M.H. 1-96.	7-5-60
2-1323	Las Lomas. Asphalt sealing downstream from M.H. 1-94.	7-20-60
2-1324	Las Lomas. Asphalt sealing downstream from M.H. 1-94.	7-20-60
2-1325	Las Lomas. Asphalt sealing downstream from M.H. 1-94.	7-20-60
2-1326	Las Lomas. Asphalt sealing downstream from M.H. 1-94.	7-20-60
2-1327	Las Lomas. Asphalt sealing downstream from M.H. 1-94.	7-20-60
2-1328	Las Lomas. Asphalt sealing downstream from M.H. 1-94.	7-21-60
2-1329	Las Lomas. Asphalt sealing downstream from M.H. 1-94.	7-21-60
2-1330	Las Lomas. Asphalt sealing downstream from M.H. 1-94.	7-21-60
2-1331	Las Lomas. Asphalt sealing downstream from M.H. 1-94.	7-21-60
2-1332	Las Lomas. Asphalt sealing downstream 12 feet from M.H. 1-94.	7-21-60

Slide No.	Description	Date
2-1333	Las Lomas. Asphalt sealing 12 feet downstream from M.H. 1-94.	7-21-60
2-1334	Las Lomas. Asphalt sealing 16 feet downstream from M.H. 1-94.	7-21-60
2-1335	Las Lomas. Asphalt sealing 16 feet downstream from M.H. 1-94.	7-21-60
2-1336	Las Lomas. Asphalt sealing upstream from M.H. 1-97 2 inches above the pipe.	7-21-60
2-1337	Las Lomas. Asphalt sealing upstream from M.H. 1-97-5 inches above the pipe.	7-21-60
2-1338	Las Lomas. Asphalt sealing upstream from 1-97 top of pipe.	7-21-60
2-1339	Las Lomas. Asphalt sealing upstream from M.H. 1-97 top of pipe.	7-21-60
2-1340	Las Lomas. Asphalt sealing upstream from M.H. 1-97 top of pipe.	7-21-60
2-1341	Las Lomas. Asphalt sealing upstream from M.H. 1-97.	7-21-60
2-1342	Las Lomas. Asphalt sealing, upstream from M.H. 1-97.	7-21-60
2-1343	Las Lomas. Asphalt sealing, upstream from M.H. 1-97.	7-21-60
2-1344	Las Lomas. Asphalt sealing upstream from M.H. 1-97.	7-21-60
2-1345	Las Lomas. Asphalt sealing upstream from M.H. 1-97.	7-21-60
2-1346	Las Lomas. Asphalt sealing upstream from M.H. 1-97 top of pipe.	7-21-60
2-1347	Las Lomas. Asphalt sealing 6 feet west of 1-94.	7-27-60
2-1348	Las Lomas. Asphalt sealing 6 feet west of M.H. 1-94	7-27-60
2-1349	Las Lomas. Asphalt sealing 6 feet west of M.H. 1-94.	7-27-60
2-1350	Las Lomas. Asphalt sealing 6 feet west of M.H. 1-94.	7-27-60
2-1351	Las Lomas. Asphalt sealing 6 feet west of M.H. 1-74.	7-27-60
2-1352	Cuneo Road. Asphalt sealing house service.	7-27-60
2-1353	Cuneo Road. Asphalt sealing house service.	7-27-60

Slide No.	Description	Date
2-1360	Arroyo and Vallejo. Root in house service sewer.	8-30-60
2-1367	Las Lomas. south of M.H. 1-90.	10-3-60
2-1368	Las Lomas. South of M.H. 1-90.	10-3-60
2-1370	Las Lomas. South of M.H. 1-90.	10-4-60
2-1371	Las Lomas. Excavation south of bridge at wye.	10-11-60
2-1373	Splude Road recorder at 12:05 p.m. Wet weather.	12-1-60
2-1374	Splude Road recorder 12:05 p.m. wet weather.	12-1-60
2-1376	Splude Road Recorder 12:10 p.m. Wet Weather.	12-1-60
2-1395	House service 455 Vallejo.	12-16-60
2-1397	Las Lomas. House service on Weener's property.	9-11-60
2-1399	Sonoma Valley L.I.D. No. 1. Condition of upstream part of bridge on Las Lomas.	9-30-60
2-1400	L.I.D. No. 1. Water test at bridge on Las Lomas.	9-30-60
2-1403	L.I.D. No. 1. Condition of upstream part of bridge on Las Lomas.	9-30-60
2-1405	Las Lomas bridge. Dye test.	10-3-60
2-1408	Las Lomas. Dyed water. House service south of Arroyo	10-4-60
2-1410	Las Lomas. House service by bridge encased in concrete	10-10-60
2-1412	Las Lomas. House service at bridge prior to encasing in concrete.	10-10-60.
2-1415	Las Lomas. Excavation south of bridge at wye of house service.	10-11-60
2-1417	Las Lomas. South of bridge. Excavation to inspect pipe	10-11-60
2-1420	475 Calle del Monte. House service Ray McIntyre.	9-21-60
2-1424	38 Calle del Monte. House service repaired.	10-7-60
2-1430	130-140 Calle del Monte. House service. Bad joint.	11-3-60
2-1431	110 Calle del Monte. Lot 7 block 5. House service very bad.	11-8-60.

Slide No.	Description	Date
2-1432	18 Calle del Monte. House service shows SC-1.	11-9-60
2-1434	Calle del Monte. House service. Reynolds house.	11-14-60
2-1436	50 Calle del Monte. House service.	11-16-60
2-1438	50 Calle del Monte. House Service. Rear bad service	11-21-60
2-1440	50 Calle del Monte. House service.	11-22-60
2-1444	200A Calle del Monte. Prior to repair house service.	12-23-60
2-1445	200A Calle del Monte. Repaired house service.	12-27-60
2-1446	200A Calle del Monte. Repaired house service.	12-28-60
2-1450	Calle del Monte. House service, Ruise. Second treatment.	3-17-61
2-1454	Arroyo. House service Reynolds property.	10-3-60
2-1452	Arroyo. Ramsey house service sewer.	9-30-60
2-1455	Arroyo. Reynold's property house service.	10-3-60
2-1457	Arroyo. House service lot 10 block 12.	10-18-60
2-1461	First Street. House service. Gitty property.	11-28-60
2-1463	450 First Avenue. House service	1-10-61
2-1465	Barnes and Central. House service, northwest corner.	12-8-60
2-1466	Barnes and Central. House service, northwest corner.	12-8-60
2-1475	26-28 Maldanado Drive. House service.	1-5-61
2-1476	26-28 Maldanado Drive. House service.	1-5-61
2-1477	26-28 Maldanado Drive. House service.	1-5-61
2-1480	14 Fourth Street. House service repair.	2-21-61
2-1491	Las Lomas. Cleanout 96-1.	1-12-61
2-1492	Las Lomas. Cleanout 98-1.	1-18-61
2-1493	Las Lomas. Cleanout 98-1.	1-18-61

Slide No.	Description	Date
2-1494	Asphalt inside house at 600 Calle del Monte before cleanout.	2-13-61
2-1495	Asphalt inside house at 600 Calle del Monte before cleanout.	2-13-61
2-1497	Asphalt inside house at 600 Calle del Monte after cleanout.	2-13-61
2-1498	Asphalt inside house at 600 Calle del Monte after cleanout.	2-13-61
2-1504	Fresh oil signs	3-27-61
2-1503	Fresh oil signs	3-27-61
2-1507	14 Fourth Street. House service repair.	2-21-61
2-1508	26-28 Maldanado Avenue. House service.	5-5-61
2-1510	200A Calle del Monte. House service. Shows RS-1 and SC-1.	12-22-60
2-1513	Las Lomas. Excavation at south side of bridge at wye. House service excavation to inspect line.	10-11-60.
2-1514	455 Vallejo. House service.	12-16-60
2-1515	403 Vallejo. Repair of house service.	4-18-61
2-1516	Central Avenue. House service repair Wright's property.	9-10-60.
2-1517	Baines and Central. House service at northwest corner.	12-9-60.
2-1518	999 Central. House service repair.	12-5-60
2-1520	Arroyo Ramsey house service. Condition of clay joint.	9-30-60
2-1522	Sonoma Valley crew drilling for applicator in M.H. 24	11-3-60
2-1530	403 Vallejo. House service repair.	4-15-61
2-1531	49 Thomson Avenue. House service repair.	4-25-61
2-1532	49 Thomson Avenue. House service repair.	4-25-61
2-1533	49 Thomson Avenue. House service repair.	4-25-61

Slide No.	Description	Date
2-1536	RS-1 test at the corporation yard.	4-21-61
2-1537	RS-1 test at South Park corporation yard.	4-21-61
2-1540	RS-1 test at the corporation yard.	4-21-61
2-1542	RS-1 test corporation yard.	4-21-61
2-1544	RS-1 test at the corporation yard.	4-21-61
2-1548	RS-1 test at the corporation yard.	4-21-61
2-1550	RS-1 test at the corporation yard.	4-21-61
2-1552	RS-1 test South Park corporation yard.	4-21-61
2-1584	RS-1 test South Park corporation yard.	4-21-61
2-1587	RS-1 test South Park corporation yard.	4-21-61
2-1599	Thomson Avenue. Sealing project.	5-31-61
2-1600	Thomson Avenue.	5-31-61
2-1601	Thomson Avenue. Barrels	5-31-61
2-1602	Thomson Avenue. Barrels between M.H. 17 and 18.	5-31-61
2-1606	Thomson Avenue. Sonoma Valley sealing project.	6-15-61
2-1614	18 Thomson Avenue. House service.	7-6-61
2-1656	Locations of applicators and asphalt barrels along easement.	8-7-61.
2-1658	Locations of applicators and asphalt barrels along easement.	8-7-61
2-1659	Locations of applicators and asphalt barrels along easement.	8-7-61
2-1660	Locations of applicators and asphalt barrels along easement.	8-7-61
2-1661	Locations of applicators and asphalt barrels along easement.	8-7-61
2-1662	Locations of applicators and asphalt barrels along easement.	8-7-61

Slide No.	Description	Date
2-1663	Locations of applicators and asphalt barrels along easement.	8-7-61
2-1664	Locations of applicators and asphalt barrels along easement.	8-7-61
2-1729	Verde Vista. Excavation between M.H. 92 and 93.	9-19-61
2-1731	Verde Vista. Excavation between M.H. 92 and 93.	9-19-61
2-1732	Verde Vista. Excavation between M.H. 92 and 93.	9-19-61
2-1733	Verde Vista. Excavation between M.H. 92 and 93.	9-19-61
2-1735	Verde Vista. Excavation between M.H. 92 and 93.	9-19-61
2-1754	No. 4 Fourth Street. House service repair. Shows SC-1 and RS-1.	12-6-61
2-1755	18443 First Avenue. House service repair.	12-12-61
2-1756	18443 First Avenue. House service repair.	12-12-61
2-1759	No. 5 Bonita Way. House service repair.	12-15-61
2-1760	No. 5 Bonita Way. House service repair.	12-15-61
2-1761	No. 5 Bonita Way. House service repair.	12-15-61
2-1762	No. 5 Bonita Way. House service repair.	12-15-61
2-1763	80 Vallejo. House service repair.	1-16-62
2-1764	80 Vallejo. House service repair.	1-16-62
2-1765	80 Vallejo. House service repair.	1-16-62
2-1766	80 Vallejo. House service repair.	1-16-62
2-1768	80 Vallejo. House service repair.	1-16-62
2-1776	Easement south of Center St. and east of Arnold Drive Roots from choked sewer.	12-6-61
2-1777	Central Avenue.	11-3-61
2-1778	Central Avenue.	11-3-61

Slide No.	Description	Date
2-1779	Central Avenue	11-3-61
2-1780	Central Avenue	11-3-61
2-1784	Excavation for M.H. 60A for flow recorder.	11-16-61
2-1785	Johnson Avenue. Sewage flow recorder at M.H. 71	2-7-62
2-1786	Sewage flow recorder at M.H. 60A	2-7-62
2-1799	369 Calle del Monte. RS-1 application on house service.	4-6-62
2-1800	514 Baines Avenue. RS-1 application.	6-29-62
2-1801	514 Baines Avenue. RS-1 application.	6-29-62
2-1802	RS-1 application.	8-6-62
2-1804	RS-1 application M.H. T-71	8-6-62
2-1806	Sewer main repair at M.H. T-71	8-6-62
2-1808	Southeast corner of Bernard and Balsam. Barrels	6-15-62
2-1809	Southeast corner of Bernard and Balsam. Barrels	6-15-62
2-1810	Fetters Avenue M.H. 109 to 110. Barrels set on street.	6-15-62
2-1811	Thomson Avenue at Vallejo. Northwest corner.	6-62
2-1813	Waterman Avenue. Block C lot 13. House stub after treatment.	7-27-62
2-1814	Park Avenue. East side. Above M.H. 119 house service.	7-62
2-1828	Waterman Avenue. Asphalt sealing of house service. First house west of Highland.	8-28-62
2-1830	Waterman at Middlefield. Asphalt sealing.	8-28-62
2-1832	Vallejo. Asphalt sealing 10 feet east of M.H. 83	10-17-62
2-1835	Bonita Way. Asphalt sealing 150 feet south of M.H. 76.	10-17-62
2-1839	Sunset Avenue. North of Waterman. Stoppage in line between applicators 5 and 6.	11-20-62

Slide No.	Description	Date
2-1919	Mountain and Hillcrest. Asphalt sealing.	9-10-63
2-1993	M.H. 1-96. Hydrostatic test following line sealing.	8-30-60
2-1994	M.H. 1-96. Hydrostatic test following line sealing.	8-30-60
2-1995	M.H. 1-96. Hydrostatic test following line sealing.	8-30-60
2-1996	M.H. 1-96. Hydrostatic test following line sealing.	8-30-60
2-1997	M.H. 1-96. Hydrostatic test following line sealing.	8-30-60
2-1998	M.H. 1-96. Hydrostatic test following line sealing.	8-30-60